ELEMENTS

OF

MATERIA MEDICA AND THERAPEUTICS.

PRINTED BY J. MALLETT, 59, WARDOUR STREET, LONDON.

ELEMENTS

OF

MATERIA MEDICA

AND

THERAPEUTICS;

INCLUDING THE

RECENT DISCOVERIES AND ANALYSIS OF MEDICINES.

ANTHONY TODD THOMSON, M.D. F.L.S.

FELLOW OF THE ROY. COL. OF PHYSICIANS;
PROFESSOR ON MATERIA MEDICA, THERAPEUTICS, AND FORENSIC MEDICINE,
IN UNIVERSITY COLLEGE, LONDON;
ETC. ETC. ETC.

Third Edition.

ENLARGED AND IMPROVED.

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TO

THE RIGHT HONORABLE

HENRY, BARON BROUGHAM AND VAUX, F.R.S.

&c. &c.

PRESIDENT OF UNIVERSITY COLLEGE, LONDON;

AS A PUBLIC TESTIMONY

OF

RESPECT FOR HIS SCIENTIFIC ACQUIREMENTS

IN EVERY BRANCH OF NATURAL SCIENCE;

ADMIRATION OF HIS UNWEARIED EFFORTS FOR

THE ADVANCEMENT OF EDUCATION

AND

THE DIFFUSION OF KNOWLEDGE;

AND

AS A TRIBUTE OF THE HIGH ESTIMATION WHICH

THE AUTHOR PLACES UPON HIS FRIENDSHIP,

THIS VOLUME

IS

RESPECTFULLY INSCRIBED.

PREFACE

TO THE FIRST EDITION.

The intention of the following pages is to present a condensed view of the branch of medical science of which they treat. The extent and nature of the subject have been too little considered, and the preliminary acquisitions requisite for its proper acquirement most unaccountably overlooked, in the course of studies prescribed by the incorporated medical bodies in this country. Instead of commencing his medical education by attending lectures on Materia Medica, which is an obligation imposed upon him by the existing regulations, the student should previously attend, at least, one course of Natural History, Botany, Chemistry, Anatomy, and Physiology; and not till then can he be expected to comprehend the doctrines delivered in a course of Materia Medica, far less those relating to Therapeutics. The Author flatters himself that the contents of the following pages will render evident this mistake in medical education; and, consequently, effect its correction.

The Author has adopted that arrangement of his subject which he thinks the best calculated to make the work useful, both to the student and the junior practitioner; and, by collecting in one point of view all the discoveries with which modern Chemistry has enriched the field of Materia Medica, and those practical facts which clinical medicine has furnished for elucidating the doctrines of Therapeutics, he hopes that it may not be considered unworthy of the attention of the experienced practitioner. He has lost no opportunity of availing himself of the labours of the Continental Chemists and Medical Writers, as well as those of our own country,

and our transatlantic brethren. He has, indeed, had recourse to every original source of information within his reach; and he trusts that the composition of the work will demonstrate that his diligence has not been misapplied.

Although the greatest portion of the work can be regarded only as a compilation, yet, the Author has introduced into its pages the results of thirty years of attentive and close observation in the treatment of diseases. With an enthusiastic love and a veneration for his profession, which he is anxious to impress upon those who are commencing the study of its principles, he has endeavoured to trace the nature and the phenomena of morbid action, and to ascertain the actual influence exerted by remedial agents in effecting its removal. What he has observed he has faithfully recorded; and he has distinguished, as far as his experience has enabled him to verify the statements of others, facts from conjectures, and truth from misrepresentation. Still, however, the ample field of Materia Medica remains imperfectly cultivated: if the following pages only excite those calculated to draw forth the riches of the soil to lend their aid to the task, the Author will rest satisfied with the result of his exertions

3, *Hinde Street, Manchester Square,*
25th September, 1832.

ADVERTISEMENT

TO THE THIRD EDITION.

In presenting a new edition of this work to the notice of the Profession, the Author has merely to remark, that he has endeavoured to correct any errors of the first and the second editions, and to collect as much new information to enrich the pages of the present edition as his opportunities have afforded. The intimate dependence of Materia Medica upon Chemistry renders it, like that highly interesting branch of Science, liable to constant fluctuations; because every day is presenting new materials, and affording facilities of analysis which had not previously existed. The Author has taken advantage of these, and has consulted every new work, both foreign and domestic, which has appeared within the last six years, connected with his subject; and he trusts that the results of his industry, in the pages of this volume, will be sufficiently apparent to his readers. He has only to add, that the work is not intended to afford minute details of the Natural History and the commerce of the Medicinal Agents it treats of*; but to supply that general information respecting the chemistry and therapeutical employment of the articles of the Materia Medica, which is likely to prove practically useful to students and junior practitioners of the Healing Art. With this declaration, he commits the present edition to the press; and on the judgment of the Profession he relies for that reception of it which its merits shall be thought to deserve, and beyond which he has no desire to claim either favour or patronage.

* On these points, every satisfactory information may be obtained from Dr. Pareira's justly appreciated volumes.

30, *Welbeck Street, Cavendish Square,*
28th November, 1842.

CONTENTS.

PART I.

GENERAL ACTION OF MEDICINES.

PART II.

CLASSIFICATION OF MEDICINAL AGENTS.

PART III.

PART IV.

CHEMICAL AGENTS.

PART V.

MECHANICAL AGENTS.

APPENDIX.

CORRIGENDA.

Page 132, line 6 from bottom, *for* Subcarbonate *read* Sesquicarbonate.
—— 156, — 9 from bottom, *for* L *read* D.
—— 161, — 6 from top, *for* Bycyanidum *read* Bicyanidum.
—— 172, — 16 from bottom, *for* Bromida *read* Bromidum.
—— 324, *for* PONDERABLE *read* IMPONDERABLE.
—— 973, *for* INDIRECT *read* DIRECT.
—— 1075, *for* SALANUM *read* SOLANUM.
—— 114*, *for* FELICALES *read* FILICALES.
—— 117*, line 22 from top, for *vverrucosum* read *verrucosum*.
—— ib. — 21 from bottom, dele ?
—— 118*, — 5 from top, dele ?
—— ib, lines 20, 17, 11, for *Bonplandia* read *Bonplandi*.

APPENDIX.

1.—TABLE OF CHEMICAL EQUIVALENTS OF SUBSTANCES BELONGING TO THE MATERIA MEDICA*.

ELEMENTARY SUBSTANCES.

	H as 1.	O as 100.	H as 1.
Aluminium...	13·72	171·17	13·7
Antimony....	129·24	1612·20	64·6
Arsenic......	75·34	940·16	37·7
Barium......	68·66	856·88	68·7
Bismuth*....	71·07	886·92	71·0
Boron.......	10·91	136·25	10·9
Bromine.....	78·39	978·31	78·4
Calcium.....	20·52	256·02	20·5
Carbon......	6·13	76·14	6·12
Chlorine.....	35·47	442·65	35·42
Copper......	31·71	395·70	31·6
Gold*........	199·21	2486·03	199·2
Hydrogen....	1·00	1247·95	1
Iodine.......	126·57	1579·50	126·3
Iron........	27·18	339·21	28
Lead........	103·73	1294·50	103.6
Magnesium...	12·69	158·37	12·7
Manganese...	27·72	345·89	27·7
Mercury.....	101·43	1265·82	202
Nitrogen.....	14·19	177·04	14·15
Oxygen......	8·01	100·00	8
Phosphorus..	31·44	392·28	15·7
Potassium....	39·26	489·92	39·15
Silver.......	108·30	1351·61	108
Sodium......	23·31	290·90	23·3
Sulphur.....	16·12	201·17	16·1
Tin.........	58·92	735·29	58·9
Zinc........	32·31	423·20	32·3

PRIMARY COMPOUNDS.

Water.......1 H + 1 O = 9
Ammonia ...3 H + 1 N = 17·15
Etherine ....4 H + 4 C = 28·18
Naphtha ....5 H + 6 C = 41·72
Camphor ....8 H + 10 C = 69·20
Cyanogen ...1 N + 2 C = 26·39
Benzule 14 C + 5 H + 2 O = 105
Alcohol..2 C + 3 H + 1 O = 23·24
Ether....4 C + 5 H + 1 O = 37·48
Creasote 14 C + 9 H + 2 O = 110·68

Protoxides

Potassa ....1 Pot. + 1 O = 47·15
Soda ......1 So. + 1 O = 31·3
Baryta......1 Ba. + 1 O = 76·7
Lime ......1 Ca + 1 O = 28·5
Magnesia...1 Mg. + 1 O = 20·7
Of Iron ....3 Fe. + 4 O = 116
Of Zinc ....1 Zn. + 1 O = 40·3
Of Bismuth ..1 Bi. + 1 O = 79
Of Copper ..1 Cr. + 1 O = 39·6
Of Mercury..1 Hg. + 1 O = 210
Of Lead.... 1 Pl. + 1 O = 111·6

Binoxides.

Of Maganese.. 1 M. + 2 O = 43·7
Of Mercury .. 1 Hy. + 2 O = 218

Sesquioxides.

Alumina......2 Al. + 3 O = 51·4
Of Antimony..2 Sb. + 3 O = 153·2
Of Iron...... 1 Fe. + $1\frac{1}{2}$ O = 40

Mixed Oxides.

Black Oxide of Iron:
2 Protox. = 72 } = 112
1 Sesquiox. = 40 }
Red Oxide of Lead:
2 Protox. = 223·2 } = 342·8
1 Perox. = 119·6 }

Acids.

Acetic ...4 C + 3 H + 3 O = 51·48
Arsenious ....2 As. + 3 O = 99·1
Antimonious ..2 Sb. + 4 O = 162·2
Benzoic 14 C + 5 H + 3 O = 114·68
Boracic ....1 B + 3 O = 34·9
Carbonic.......1 C + 2 O = 22·12
Citric ....4 C + 3 H + 5 O = 67·48
Camphoric..10 C + 8 H + 5 O = 109·2
Chloric......1 Chl. + 5 O = 75·42
Gallic....7 C + 3 H + 5 O = 85·84
In Crystals .... 1 W. = 93·81
Hydrocyanic ..1 Cy. + 1 H = 27·39
Hydriodic ....1 Iod + 1 H = 127·3
Hydrochloric 1 Chl. + 1 H = 36·42
Hydrosulphuric..1 H + 1 S = 17·1
Iodic ....1 Iod. + 5 O = 166·3
Kinic 13 C + 10 H + 10 O = 181·8
Malic ....4 C + 2 H + 4 O = 58·18
Meconic 17 C + 2 H + 7 O = 100·84
Nitrous ......1 Nit. + 4 O = 46·15
Nitric... .....1 Nit. + 5 O = 54·15
Oxalic .... 2 C + 3 O = 36·24
Tannic (from Catechu) 18 C + 9 H + 8 O = 183·16
—— (from Galls), 18 C + 9 H + 12 O = 215·16
Tartaric..4 C + 2 H + 5 O = 66·48
Phosphoric ....2 P + 5 O = 70·14
Uric..5 C + 2 H + 2 N + 3 O = 84·9
Sulphuric ......1 S + 3 O = 40·1
Succinic..4 C + 2 H + 3 O = 50·48

Vegetable Alkaloids and Resinoids.

Delphia..27 C + 19 H + N + 2 O = 214·39
Morphia:
35 C + 20 H + 1 N + 6 O = 296·35
Codeia:
31 C + 20 H + 1 N + 5 O = 288·35

* This Table contains the corrections of Berzelius, Turner, and others. In the first column of the elementary substances, the unit is Hydrogen, and the equivalents; in the second, Oxygen is 100; and the third contains the equivalents given in this volume; and generally used in this country.

Cinchonia:
20 C + 12 H + 1 N + 1 O = 156·55
Quina:
20 C + 12 H + 1 N + 2 O = 164·55
Strychnia:
44 C + 23 H + 2 N + 4 O = 352·58
Brucia:
48 C + 27 H + 2 N + 8 O = 413·06
Emetia:
35 C + 25 H + 1 N + 9 O = 306·35
Conia:
12 C + 14 H + 1 N + 1 O = 110·59
Elateria:
6 C + 12 H + — + 5 O = 88·72
Emulsin:
24 C + 23 H + 4 N + 9 O = 299 48
Amygdalin:
40 C + 27 H + 1 N + 22 O = 293·95
Calumbin:
12 C + 7 H + 4 O = 112·44
Picrotoxia:
12 C + 7 H + 5 O = 120·44
Ménispermia:
18 C + 12 H + 1 N + 2 O = 152·31
Paramorphia:
25 C + 18 H + 1 N + 14 O = 297·15
Pseudomorphia:
27 C + 18 H + 1 N + 14 O = 309 39
Narceia:
28 C + 20 H + 1 N + 12 O = 301·51
Narcotina:
48 C + 24 H + 1 N + 15 O = 451.91
Veratria:
34 C + 22 H + 1 N + 6 O = 252·23

Resinoids.

Caffein:
8 C + 5 H + 2 N + 2 O = 98 26
Salicina:
2 C + 2 H + 1 O = 22·42

Chlorides.

Chl. of Barium, 1 Ch. + 1 B. = 104 12
—— Sodium, 1 Ch. + 1 So. = 58·72
—— Calcium, 1 Ch. + 1 Cal. = 55·92
Sesquichloride of Antimony:
1 Sb + 1½ Chl. = 117·28
Chloride of Mercury:
1 Hg. + 1 Chl. = 237·42
Bichloride of Mercury:
1 Hg. + 2 Chl. = 272·82
Sesquichloride of Iron:
1 Fe. + 1½ Chl. = 81·13
Chloride of Lead 1 Pl. + 1 Chl. = 139·02
—— of Zinc, 1 Z. + Chl. = 67·72

Cyanides.

Of Potassium, 1 P + 1 Cy. = 65·54
Of Mercury 1 Hg. + 2 Cy. = 228·39
Cyanide of Silver 1 Cy. + 1 S = 134·39

Iodides.

Iod. of Potassium, 1 P + 1 I = 165·4 5
Iodide of Iron, ... 1 Fe. + 1 I = 154 3
Iodide of Zinc, ... 1 Zn. + 1 I = 158·6
Period. of Arsenic, .. 2 A. + 5 I = 706·9
Iodide of Lead, .. 1 Pl. + 1 I = 229·9
—— Mercury, .. 1 Hg. + 1 I = 328·3
Sesqui-iodide of Mercury:
2 Hg. + 3 I = 782·9
Biniodide of Mercury:
1 Hg. + 2 I = 454·6
Iodide of Sulphur:
2 Sulph. + 1 I. = 158 5

Bromides.

Brom. of Potassium, 1 B + 1 O = 117.55

SECONDARY COMPOUNDS.

Oxy-salts.

Sulphate of Potassa:
1 P + 1 S ac. = 87·25
Bisulphate of Potassa:
1 P + 2 S ac. = 127·36
Crystals, 1 Water .... 145·36
Sulphate of Soda:
1 So. + 2 S ac. = 71·4
Crystals, 10 Water .... 161·4
Bisulphate of Soda:
1 So. + 2 S ac. = 111·5
Crystals, 4 Water .... 147·5
Sulphate of Magnesia:
1 Mg. + 1 S ac. = 60·8
Crystals, 7 Water .... 123·8
Sulphate of Protoxide of Iron:
1 Fe. O + S ac. = 76·1
Crystals, 6 Water .... 130·1
Sulphate of Zinc:
1 Zn. O + 1 S ac. = 80·4
Crystals, 7 Water .... 143·4
Sulphate of Copper:
1 Cu. O + 1 S ac. = 79·7
Subsulphate of the Peroxide of Mercury, 1 Hg. + 1 S ac. = 258.1
Chlorate of Potassa:
1 Ch. ac. + 1 Pot. = 122·57
Alum:
Sulph. Potassa, 1 eq. .... } = 258·95
Tersulph. Alumina, 1 eq... }
Crystals, 25 Water .... 483·95
Nitrate of
Potassa, 1 Pot. + 1 N ac. = 101·3
Silver, 1 Sil. + 1 N ac. = 170·15
Trisnitrate of Bismuth:
3 Ox. Bism. + 1 ac. = 291·15
Nitrate of Lead, 1 Pl. + 1 ac. = 157·75
Phosphate of Soda:
1 Soda + 1 P ac. = 101·44
Crystals, 12½ Water .... 213·94
Biborate of Soda:
1 So. + 2 B ac. = 101·1
Crystals, 10 Water .... 191·1
Acetate of
Potassa.... 1 Pot. + 1 A ac. = 98 63
Lead. , .. 1 Pl + 1 A ac. = 200·48
Mercury, 1 Hg. + 10 + 1 ac. = 261·48
Copper.... 1 Cu. + 1 A ac. = 100·08
Diacetate of
Lead .... 2 Ox. Pl. + 1 ac. = 276·27

Carbonate of Potassa:
1 Po. + 1 C ac. = 69.27
Bicarbonate of Potassa:
1 Po. + 2 C ac. = 91·39
Crystals, 1 Water .... 100·39
Carbonate of Soda:
1 So. + 1 C ac. = 53·42
Crystals, 10 Water.......... 143·42
Bicarbonate of Soda:
1 So. + 2 C ac. = 75·54
Crystals, 2 Water .... 93·54
Carbonate of Ammonia:
1 Am. + 1 C ac. = 39·37
Bicarbonate of Ammonia:
1 Am. + 2 C ac. = 61·39
Carbonate of
Lime, 1 Lime + 1 C ac. = 50·72
Magnesia, 1 Mg. + 1 C ac. = 42·82
Carbonate of Baryta:
1 Bar. + 1 C. ac. = 98·82
Carbonate of Iron:
1 Fe. Ox. + 1 C ac. = 58.12
Carbonate of Lead:
1 Pl. + 1 C ac. = 133·72
——— Zinc, 1 Z. + 1 C. a = 62·42
Tartrate of Potassa:
1 Pot. + 1 T ac. = 115·63
Bitartrate of Potassa:
1 Pot. + 2 T ac. = 189·11
Tartrate of Pot. and Soda:
1 S.+1 Pot.+2 T. ac.+10 W.=301·41
Tart. of Antimony and Potassa = 351·31

Ammoniacal Salts.

Hydrochlorate of Ammonia:
1 H Cl. + 1 Am. = 53.57
Ammonio-Chloride of Mercury:
1 Binox. Hg. + 1 Hydrochl. ac.
+ 1 Am. = 271·57

Sulphur Salts.

Hydrosulphuret of Potassium:
1 base + 1 S ac. = 72·35
Hydrosulphuret of Calcium:
1 base + 1 S ac. = 53 7
Hydro-Sulph. of Ammonia:
1 Amm. + 1 Hydro-Sulph. ac. = 30 16

Ferro-cyanides.

Ferro-cyanides of Potassium:
1 Basic Cyan. + 1 Co. Fe. = 155·47
Crystals, 3 Water .... 212·47

Salts of Vegetable Alkalies.

Sulphate of Morphia:
1 Morph.+1 Acid 6 Water = 382·33
Sulphate of Cinchonia:
1 Cin. + 1 Acid + 4 Water = 232·65
Sulphate of Quina:
2 Quina + 1 ac. + 10 Water = 419·2
Hydrochlorate of Strychnia:
1 Base + Acid = 274·17
Sulphate of Strychnia:
1 Base + 1 ac. + 3 Water = 304·85
Hyduret of Benzule:
1 Benz. 1 Hyd. = 107·68

Sulphurets.

Sulphuret of Potassium:
1 P + 1 S = 55·25
Sulphuret of Calcium:
1 Ca. + 1 S = 36·6
Bisulpuret of Iron, 1 Fe. + 2 S = 60·2
Sesqui-sulphuret of Antimony:
2 Sb. + 3 S = 177·5
Oxy-Sulphuret of Antimony:
$\left.\begin{array}{l}\text{Sesqui-S. 2 eq. ....}\\ \text{Sesqui-Ox. 1 eq.........}\end{array}\right\}$ = 508·2
Protosulphuret of Mercury:
1 Hg. + 1 S = 218·1
Bisulphuret of Mercury:
1 Hg. + 2 S = 234·2

II.—TABLE OF THE PER CENTAGE OF THE COMPONENTS OF SEVERAL VEGETABLE AND ANIMAL SUBSTANCES, ARTICLES OF THE MATERIA MEDICA

Vegetable Substances.

		CARB.		HYD.		NITROG.		OXY.	
Amygdalin		52 516	+	5·908	+	3 064	+	38·512 in	100 parts
Aricina		70·59	+	7·06	+	8·23	+	14·12	100
Bees' Wax.......	U.	80·4	+	11·3	+		+	8·3	100
Brucia..........	L.	70·88	+	6·66	+	5 07	+	17·39	100
Calumbin	L.	65·45	+	6·18	+		+	28·37	100
Camphor	D.	78·012	+	10·39	+		+	11·59	100
Conia	L.	66·913	+	12·0	+	12·805	+	8·282	100
Creasote..........		77·42	+	8·12	+		+	14·16	100

Vegetable Substances.

		CARB.		HYD.		NITROG.		OXY.	
Delphia..........	L.	76·69	+	8·89	+	5·93	+	7·49	in 100 parts.
Elateria..........	H.	36·9	+	28·9	+		+	30·392	100
Emulsin	R.	48·835	+	7·732	+	18·911	+	24·722	100
Emetia	L.	64·57	+	7·77	+	4	+	22·95	100
Gum Arabic......	G.L.	42·23	+	6·93	+		+	50·84	100
Guaiacum........	U.	67·88	+	7·05	+		+	25·07	100
Mannite	P.	38·7	+	6·8	+		+	54·5	100
Meconine........	C.	60·247	+	4 756	+		+	34 997	100
Narcotina........	L.	65	+	5·6	+	2 51	+	26 99	100
Narceia..........	L.	54·73	+	6 52	+	4·33	+	34·42	100
Olive Oil.........	G.L.	77·213	+	13·36	+		+	9·427	100
Oil of Cloves	D.	70·02	+	7·42	+		+	22·56	100
Oil of Bitter Almonds	L.	79·56	+	5·56	+		+	14·88	100
Picrotoxia.......	O.	61·434	+	6·11	+		+	32·456	100
Piperina.........	G.	80 95	+	8·13	+		+	10·92	100
Quina	L.	74·40	+	6·66	+	8·45	+	10·43	100
Quassina.........	W.	66·912	+	6·827	+		+	26·261	100
Resin	G.L.	75·944	+	10·719	+		+	12·337	100
Smilacin.........	P.	62·8	+	9 14	+		+	28·06	100
Salacina	Pe.G.L.	55·48	+	6·38	+		+	38·13	100
Solania..........	Bl.	62·11	+	8 92	+	1·64	+	27·33	100
Strychnia	L.	76·43	+	6·70	+	5·81	+	11 06	100
Ulmin	B.	56 7	+	8·3	+		+	36	100
Veratria	C.	70·786	+	7·636	+	5·210	+	16·368	100
Volatile Oil of Mustard ..		49·84	+	5·09	+	14·41	+	10·18	100

Animal Substances.

Albumen.........	P.	50	+	7·78	+	15·55	+	26·67	100
Cantharidin......	Reg.	61·68	+	6·04	+		+	32·28	100
Cetine		81·666	+	12·862	+		+	4·578	100
Gelatin	G.L.	47·881	+	7·914	+	16·998	+	27·207	100
Spermaceti.......		79·5	+	11·6	+		+	8·9	100
Urea............	P.	19 99	+	6·66	+	46·66	+	26·66	100

L. Leibeg; O. Opperman; P. Prout; U. Ure; G. Gobel; G. L. Gay Lussac; D. Dumas; B Bouilay; C. Couerbe; H. Hennell; P. Petersen; Pe. Pelonge; Bl. Blanchet; R. Richardson; W. Wiggers; R. Regnaud.

INDEX.

FINIS.

J. MALLETT, PRINTER, 59, WARDOUR STREET, LONDON.

ELEMENTS

OF

MATERIA MEDICA AND THERAPEUTICS.

PART I.

SECTION I.

DEFINITIONS. MEDICAL AGENTS: GENERAL CIRCUMSTANCES CONNECTED WITH THEIR ACTION ON THE LIVING BODY.

MATERIA MEDICA is that branch of the Medical Science which relates to the nature of Medicines. It comprehends a knowledge of these agents, both in their natural state, and as productions of the pharmaceutical art, in reference to their physical properties and their chemical compositions; and also the knowledge of the physiological influence which their administration exerts on the living body.

THERAPEUTICS is a knowledge of those phenomena of the animal body which follow the administration of medicines, and precede the restoration of health.

Medicines excite actions in the living system, and cause changes in its condition sufficient to overcome any unnatural state of one or more of its functions, which may constitute disease; thence they are calculated to favour the return of health. Their influence is greatly modified by the condition of the body: the medicine which agitates in health may sooth in disease. They are derived from both the *organic* and the *inorganic* kingdoms of Nature. The greatest number are vegetable substances; those of a mineral origin are less numerous; those which are animal productions are comparatively few.

Medicines of an animal and a vegetable nature differ from food, in containing some active principle which resists the digestive powers, and often governs them, and is consequently not adapted to repair the waste of the body. Their other components—namely, resinous, albuminous, gelatinous, saccharine,

oleaginous, feculaceous, and gummy matters—undergo digestion. The medicinal properties of organic bodies vary at different periods of their existence, and owing to changes of a functional kind. In animal bodies, they are most active during the exercise of some peculiar function; for instance, that of generative orgasm in the Musk Deer, and in Cantharides: in vegetables they often remain latent, or are not formed until the plants have attained their full growth, and are capable of exercising their reproductive faculties; as in the Lettuce, which is scarcely narcotic when young; and in Foxglove, Henbane, and some other biennials, which are unfit for medicinal use until the second year of their growth. The medicinal properties of mineral substances are always the same, the circumstances of the habit of the patient under which they are administered being equal.

Medicines operate only on the living body: indeed, they may be regarded merely as means of affecting the vitality of the animal solid, whether that exhibit itself under the phenomena of *contractility*, *irritability*, or *sensibility*, or those which follow *volition* and *association*. To produce their effects, they must be in immediate contact with some sensitive or irritable part of the body: as a preliminary step, therefore, to an enquiry into the objects of the Materia Medica, it is requisite to obtain correct ideas respecting the general manner in which medicinal agents operate on the living body; and, also, a knowledge of those conditions of the habit, constituting *health* and *disease*, by which their operation is greatly modified. Thence the intimate connection between Materia Medica and Therapeutics.

Health is that condition of the body, in reference both to its component matter and its functions, which enables it to preserve its integrity as a whole and in all its parts, and to assimilate and appropriate to its own nature things foreign to itself, and to resist the impulses of others which would prove hurtful. But, besides this harmony and equilibrium in the physical part of the system, it is also essential that the mind should be as sound as the body. It would be out of place here to endeavour to explain how the body is affected by the mind, or the mind by the condition of the body: it is sufficient to know that the healthy condition of the one is affected by the state of the other: the harmony and equilibrium of both in the same person being necessary to constitute health. *Mens sana in corpore sano.* But as the condition termed health necessarily differs according to age, sex, mode of life, custom, and other circumstances, these variations must be kept in view. In the healthful state of the habit, the stomach is an active organ; it is therefore capable of resisting the influence of many medicines which operate powerfully upon it in the opposite or diseased condition of the system.

Disease is that condition of the body in which its vitality is

either so diminished or impaired, that some, at least, of the animal and the vital functions are imperfectly performed. But in affirming that vitality is diminished or impaired, it must not be supposed that any change takes place in the principle of vitality; on the contrary, this continues the same, although the organs, in a diseased state of the body, are less sustained by its influence. As the system, therefore, cannot, in this condition, resist the influence of common matter acting by its own laws, the power which, as it were, holds the different parts of the body together, gives way, and, at length, the whole becomes the victim of the ordinary laws of the affinity of its components, or, in familiar language, death ensues. In the state of disease, also, substances taken into the stomach, instead of being properly digested, undergo the changes which they would suffer, cæteris paribus, out of the body, and obey those laws which regulate the chemical affinities of their opponents; at least, such is the case in a great degree. The stomach consequently ceases to be an active organ; for, like the rest of the system, the weaker it is, the more its function is under the influence of physical agents: and many substances received into it operate as medicinal agents, the influence of which would be resisted in a state of health. The stomach, in truth, is in a condition which may be termed *active* in health, and *passive* in disease; consequently it is variously affected by the same substances in these different conditions of the body.

A reference to the morbid condition of the body is not essential to constitute any substance a medicine. Many substances, in moderate doses, or such as operate actively as remedies in disease, do not affect the *healthy* stomach, yet there is no substance deserving the name of medicine that does not, in larger doses, more or less, make some impression upon that organ in health. Substances, however, which undergo complete digestion, rarely, if ever, operate as medicines. This conclusion is not necessarily at variance with the fact, that a substance may be partially digested, and yet it may exert a medicinal influence upon the body. Indeed, as Cullen justly remarks, "with respect to vegetables, and also some animal substances, it is often a certain portion of them only that can be subjected to our digestive organs, while the medicinal part of the same is hardly affected: and, therefore, it may be alleged, that their operation on the interior parts is not prevented by the powers of digestion*." To illustrate this by an example, let us suppose that a substance is swallowed which contains a very active medicinal principle involved in a large quantity of mucilage or amylaceous matter; for instance, *Colchicia*, in the cormus of Colchicum *autumnale*; the Fecula undergoes the action of the digestive process, whilst the Colchicia remains unaltered:

* Treatise on the Materia Medica, 2 vols. 4to.

but, being set free, it now exerts its full influence upon the system. It is, therefore, evident, that, although the digestive function interferes, more or less, with the operation of medicines taken into the stomach, and the condition of that organ modifies their influence in a certain degree, yet we may strictly affirm that a medicine is neither digested nor assimilated. Having settled this point, and understanding by the term "Medicine" a substance which is capable of altering the condition of the body, whether in health or in disease, we have next to enquire in what manner medicinal agents operate upon the living body?

There are six distinct modes in which medicines act upon the living body.

1. They may act by a direct impression upon the surface to which they are applied, the effect being confined to the part.

2. They may act by an impression upon the nerves of the surface to which they are applied, and the effect be extended to the other parts of the system.

3. They may be conveyed by absorption, undecomposed, into the system, and influence the habit through the medium of the circulation.

4. They may be decomposed, and operate only by one or more of their constituents.

5. They may operate by counter-irritation or revulsion.

6. They may exert a chemical action on the tissues.

1. DIRECT ACTION OF MEDICINES; THE EFFECT BEING LOCAL.

When a medicine is taken into the stomach, or is applied to any part of the living surface, its direct and sole operation may be confined to a physical change impressed on the tissue of the organ; and, although the function of the part, if weakened, may be thus restored to a state of healthful energy, and the entire system benefited by the change, yet the influence of the medicine can only be regarded as strictly affecting the condition of the vital surface to which it is applied. This mode of action is well illustrated in the influence which Astringents, whether taken into the stomach, or injected into the rectum, exert in checking diarrhœa depending on a mere relaxation of the intestinal canal; or when employed as gargles in Cynanche *tonsillaris*; and in the effect of Collyria applied to a blood-shot eye. It is the simplest kind of medicinal action.

2. ACTION OF MEDICINES ON THE NERVOUS SYSTEM; THE EFFECT BEING GENERAL.

When the influence of medicines, acting on the stomach, extends to the whole of the system, it is evident that their im-

pression must be made upon the sensible and irritable parts of the organ; in no other manner can we account for the sudden changes produced upon distant organs and parts of the body, soon after a medicine has been introduced into the stomach. How is this to be explained?

That every medicine which operates on the living solid exerts its influence, either directly or indirectly, upon the nervous system, can scarcely be denied. Even when we admit that a medicine, which is absorbed and taken into the circulation, causes chemical changes in the circulating mass, still we must refer its ultimate effects to the nervous system, unless we suppose that the secretions are mere chemical changes in the fluids, altogether independent of the vital principle—an idea which is totally devoid of support. Chemical changes in the fluids can be more readily explained on the supposition, that, a new action being excited in the secreting organs, a change in the nature or the proportions of these fluids formed by them is the result, than by presuming that the medicine penetrates the vessels and acts chemically upon their contents. When a medicine enters the blood-vessels, and is conveyed to a particular organ, this is excited in the same direct manner as the surface to which the medicine was first applied: but, at the same time, phenomena occur in distant organs which can only be referred to nervous sympathy.

If we admit the principle that medicines can only affect the body through the medium of the nerves, when their operation extends beyond the stomach, or the part to which they are directly applied, there is no difficulty in understanding the manner in which the impression is propagated to distant parts, or over the entire system. The Physiological discoveries of Sir Charles Bell* have so far unravelled the intricacies of the nervous system as to enable us to comprehend how impressions are communicated along certain sets of nerves, while other sets remain inactive; and thence to understand how those associated changes are produced which almost simultaneously occur in distant parts. From his investigations we learn that all the nerves of sensation originate in the same medullary tract, in the spinal marrow and the brain; that a similar medium of communication unites the nerves of motion or volition; and a third, those of respiration. Now, if an impression be made on a nerve belonging to any of these sets of nerves, it is communicated to the whole set to which the affected nerve belongs, by the common medium that conjoins them. Thus, if a violent pain be felt in the great toe, as occurs frequently in gout, and is allayed by a large dose of Opium taken into the stomach, we do not suppose that the Opium is absorbed, and conveyed by the blood-vessels to the toe, in order to produce this effect:—the impression of the

* An Exposition of the Nerves, &c. 8vo.

Opium is first received by the sentient extremities of the nerves of sensation of the stomach; the new disposition given to them is propagated to the connecting tract in the spine and the sensorium commune, and thence to the part which is suffering. There is, then, a simultaneous action of some of the nerves in the most distant parts of the body—a fact which is proved by those associated impressions which are so often observed in disease; and there is equal reason for admitting that the same power regulates the operation of remedies. Let us take an example in illustration of this position. We are informed by a patient that he is suffering under palpitation of the heart; we find, upon laying our hand on the region of the heart, or by employing the stethoscope, that this organ is labouring violently, and is in the most agitated state; and yet we can detect nothing which authorizes us to suppose that this disturbance depends upon any organic disease or change in the structure of the organ. We refer it, therefore, to the stomach, which we discover to be out of health; and we say that the heart associates or *sympathizes* with the morbid action of this viscus. No remedies are, in this case, administered with the view of *directly* influencing the heart; but those are prescribed which we know will allay the morbid irritability of the stomach; and, as this object is effected, the heart also becomes quieter, and recovers its healthy action.

It may be properly demanded, what proof is there that medicines act through the medium of the nerves, independent of absorption? Two or three facts may be mentioned in support of this opinion. Rhubarb, when taken into the stomach, can be soon afterwards detected in the urine; we have, therefore, no difficulty in ascertaining whether it has been absorbed. Now, if we apply a poultice made with a strong decoction of Rhubarb to the abdomen of a child, purging is excited; but the presence of the medicine cannot be detected in the urine by the most delicate tests. If the skin of the head be bathed with a strong decoction of Tobacco, vomiting will be produced; but no absorption of the decoction of Tobacco takes place. These proofs are conclusive: but the following, of a more direct kind, may also be mentioned. M. Dupuy, having divided the nerves of the eighth pair in a horse, two ounces of Nux vomica, in the form of a bolus, were introduced into the stomach of the animal; no injurious consequences followed; although another horse, equal in size and strength to the former, in which these nerves remained entire, died in a few hours in violent tetanic convulsions, after swallowing the same quantity of the poison.

The rapidity, also, with which some medicines, Hydrocyanic acid, for example, act, when taken into the stomach, renders it, at least, doubtful whether their effects can be ascribed to absorption. Some narcotic substances, also, act powerfully when applied to the cuticle. Thus, when extract of Bella-

donna is applied to the eyelid, in order to dilate the pupil, we have no reason for thinking that the Belladonna is absorbed; and although, when it is taken into the stomach, there is a probability that absorption may take place, yet the proofs of it are not satisfactory. Upon the whole, there is abundant evidence to prove that many medicines produce their effects by acting directly through the nervous system, altogether independent of absorption. It is not essential that we should be able to demonstrate in what manner this communication with distant parts of the body is effected by the nerves. The attempt to explain the phenomenon is as vain as that respecting the vital principle; we find ourselves out of our depth, and the struggle only convinces us that we are in an element which does not belong to us.

In stating these facts, however, it must also be mentioned, that, in an experiment in which all nervous communication was destroyed, by severing the leg from the body of a dog, whilst the circulation was maintained by means of quills passing from the vessels of the body of the animal to those of the separated limb, poison introduced beneath the skin of the severed member, produced all its effects upon the animal—a circumstance which can be referred only to absorption.

In whatever way this nervous communication is accomplished, there are three surfaces upon which the impressions can be advantageously made, and from which they are propagated:—1, the stomach and alimentary canal;—2, the skin;—and 3, the lungs and the organ of smelling.

1. The first of these surfaces, the stomach, is known to be a highly irritable organ, and amply furnished with nerves: whence the sympathy which exists between it and the other parts of the system, and the advantage of administering medicine through its medium. When labouring under diseased irritation, it is the centre of perceptions felt over the whole system, and it is, at the same time, extremely susceptible of the impression of medicines; whereas, in its healthy state, it resists them powerfully.

The larger intestines are supplied with nerves connected with the great sympathetic, and communicate the impressions of medicinal agents to the general system nearly in the same manner as the stomach, but with less energy: thence, larger doses of medicines and more acrid substances can be thrown into the rectum, with impunity, than into the stomach. Medicines, also, thrown into the rectum, operate, except in degree, nearly in the same manner as those taken into the stomach.

2. The skin, the general integument of the body, is largely supplied with nerves, and endowed with great sensibility; and although the cuticle, which is devoid of sensation, is interposed between the true or sensitive skin and any substance applied to the surface, yet the skin is readily excited, and it communicates a sympathetic action to the rest of the system. That it is capa-

ble, therefore, of communicating impressions of medicinal agents is undoubted. We may mention, in confirmation of this fact, the influence of Hydrocyanic acid and Sulphuretted Hydrogen gas, as well as that of Rhubarb and Tobacco, already noticed, when applied to the unbroken surface: indeed it is highly probable that no medicinal agents applied to the skin, when the cuticle is entire, except to a small portion of the surface, are absorbed: thence, they exert their influence altogether through the medium of the nerves.

3. The third medium for receiving the impression of medicinal agents on the nervous system is the lungs and the organ of smelling. The effect in the lungs is chiefly produced on the nervus vagus; on the organ of smelling through the first and the fifth pairs of nerves distributed over the Schneiderian membrane lining the nostrils, the adjoining sinuses, and the convoluted bones so beautifully contrived to extend this surface in a limited space. Many odours cause nausea, vomiting, and rigors; and therefore it is not surprising that volatile medicines should affect the general system through the medium of the nerves of smelling. Many substances which are supposed to enter the system by pulmonary absorption, such as the fumes of Alcohol, Tobacco, and Ammonia, affect the habit by impressions made on the nervous centres through the organ of smelling, as well as by the lungs. Dr. Rousseau of Philadelphia made numerous experiments upon this subject; he states, "that they warrant the conclusion, that, by simply closing the nostrils, either by compressing them with the fingers, or by filling them up, the fumes of ardent spirits, or of a strong decoction of Tobacco, or an infusion of Opium, may be inhaled for an hour without any unpleasant effect; whereas, if the precaution mentioned be omitted, the consequences are proven to be most distressing." The substances, however, which influence the habit through the organ of smelling are few.

Such are the principal media by which medicines affect the living system through the nerves. In possessing a knowledge of them, we are led to consider — 1, the nature of the impression which any medicinal agent makes on the surface receiving it: 2, the relative connection between that part and the principal organs: 3, whether the influence of contiguity depends upon a nervous connection?

3. ACTION OF MEDICINES WHEN CONVEYED BY ABSORPTION UNDECOMPOSED INTO THE SYSTEM.

A medicine may be conveyed undecomposed into the circulation, and influence the general system.

There are three ways in which medicines may be conveyed

into the circulation:—namely, 1, by absorption from the mucous membrane of the intestinal tube; 2, by absorption through the skin; 3, by absorption through the lungs.

1. The proofs that medicines are absorbed from the intestinal canal are numerous; but a few only require to be noticed. Nitrate of Potassa, the salts of Iron, and Iodide of Potassium can be detected in the urine a few hours after they have been swallowed. This also happens when the substances are not taken into the stomach: seven minutes after injecting a solution of the Cyanide of Potassium into the bronchial cells, the presence of this salt has been demonstrated in the urine*; in which case the salt must have entered the circulation undecomposed; and the same is true respecting the Nitrate of Potassa and the Salts of Iron, before they could have appeared in the secretion of the kidneys. That such medicines do not pass, however, in the manner of digested matter through the lacteals, is probable, since they have very rarely been detected in the chyle of the thoracic duct, or in the blood, by the most delicate tests; although they have been found when introduced into the circulation through other organs than the stomach. Dr. Meyer injected Cyanide of Potassium into the lungs, through an opening in the trachea of a dog: after some time, he found it in the blood, on testing that fluid with Sulphate and Hydrochlorate of Iron. Dr. Chapman, an American writer on Materia Medica, supposes that these substances are decomposed in the stomach; that their components enter the circulation under the influence of the vital energies, which prevent them from recombining; but that, as soon as they reach the secretory or excretory organs, they are thrown, as it were, beyond the sphere of these energies; and their chemical affinities being brought into play, they recombine, and the substance is thus again rendered perceptible, so as to be detected by tests in the excretions. But however ingenious this hypothesis may be, it is utterly destitute of probability. What secretion is beyond the sphere of action of the vital energies?

The surfaces that receive the impression of medicinal agents in the intestinal canal, are all furnished with absorbents, by which the medicine is taken up: but it must be in immediate contact with these vessels. Plethora and Inflammation diminish the facility of getting medicines into the system by these channels; blood-letting and other depleting measures increase it.

2. The absorption of medicines by the *skin* is not easily demonstrated. The outer layer of the true skin is supposed to possess very feeble absorbing powers; but, nevertheless, the skin, even as it is covered with the epidermis, is indued with absorbent powers; thence, many substances, when applied to it

* Traité Elementaire de Mat. Med. par J. B. G. Barbier, &c. vol. i, p. 69.

in solution, are taken into the system. The true skin is furnished with innumerable vessels and nerves; indeed, the resemblance between it and the mucous lining of the internal, open, tubular, cavities of the body is so great, that many anatomists consider the mucous membrane as a prolongation of the skin, modified to suit the function of the part which it covers. The skin, however, differs in several particulars from the mucous membrane: it is covered with the cuticle, whilst the mucous membrane is defended by the epithelium, which in some places approaches to the character of mucus. The vascular stratum of the cutis is not separable from the thick sub-stratum which supports it, whilst in the mucous membrane these are easily separated. A question arises, does the skin actually exercise the function of absorption?

The observations and experiments of many celebrated physiologists, among whom are Drs. Klapp, Rousseau, Dangerfield, Chapman, Currie, Dr. John Gordon, and M. Seguin, tend to disprove the existence of general cutaneous absorption whilst the cuticle remains entire: but, on the other hand, experiments, as conclusive in support of the opposite opinion, are detailed by Keil, Haller, Home, Cruickshank, Watson, Ford, Abernethy, Dr. Kellie, Dr. W. F. Edwards, and others. Experiments upon the lower animals would, indeed, lead us to adopt that opinion which supposes that the skin absorbs fluids placed in contact with it; but it is from reasoning upon these analogically, that the assertion of the power of the human skin to absorb, when covered with the cuticle, solely rests. In the experiments of Seguin*, although that philosopher concludes that there is no absorption, yet, it was evident that the human body, when immersed in water above 90° of Fahr. lost nothing in weight beyond that which is usually exhaled by pulmonary transpiration; and that at 72° 5′ neither transudation nor absorption takes place. But this may have arisen as well from the cutaneous perspiration being checked, as from absorption; and such is more likely to have been the case, as no increase of weight followed. In the experiments of Drs. Currie and Gerard, in which the body was immersed in hot water, no loss of weight was suffered during the immersion; but Dr. Kellie argues in favour of absorption, from these experiments, remarking that, although the body was doubtless wasted by pulmonary and cutaneous discharges, yet its weight continued unchanged; or, where a loss was observed, this was constantly less than is experienced during the same interval in the air†. Some singular facts in favour of cutaneous absorption are related by Keil and Dr. Percival: the former says,—" 27 Decemb. hac

* La Médecine Eclairée, &c. tom. iii.
† Edin. Med. and Surg. Journ. vol. i, p. 182.

nocte octodecim humoris uncius ex aere ad se somnians (corpus) attraxit:" the latter relates the case of a horse-jockey, whose weight increased thirty ounces, although in the interval he had taken nothing but one glass of wine. That absorption occurs to a certain extent, there can be little doubt; but it is a question —whether this is a function of the whole skin, or of a part?

From some experiments instituted by Dr. Rousseau of Philadelphia, there is reason for thinking that the function of absorption is enjoyed only by certain portions of the skin; that space, for instance, which extends between the middle of the thigh and the hip; and that between the middle of the arm and the shoulder. It is not easy to explain this fact, as no anatomical peculiarity is obvious in the cuticle of these portions of the skin. Dr. Rousseau also demonstrated that Garlic, Spirit of Turpentine, and some other substances which have been supposed to find ready access to the habit through the skin, enter by pulmonary absorption. When he breathed through a tube, which passed from the room in which he was placed, and opened upon the external air, although the body was bathed with the juice of Garlic, or immersed in an atmosphere of Spirit of Turpentine, yet, these fluids were not detected either in the breath or in the urine.

Plethora diminishes the power of cutaneous absorption; but the cuticle is the chief obstacle to cutaneous absorption; yet experience has demonstrated that some medicines pass into the system, even when the cuticle is not abraded: for example, the habit may be affected by immersing the body in a bath of very dilute solution of Corrosive Sublimate, at a temperature of 70° of Fahr.; or by exposing it to mercurial fumigation. Haller, long since, observed that washing the feet with a decoction of Veratrum *album* causes violent purging. The absorption by the skin, however, is more certain when friction is employed to abrade the epidermis, or when it is removed by vesication; the skin then absorbs freely, and thus medicines have been introduced into the system by cutaneous absorption. This is, nevertheless, a very uncertain method of introducing medicines; and there is some truth in the remark of M. Barbier, that it does not fulfil all which it seems to promise*.

3. The third way by which a medicine may enter the system undecomposed, and exert its influence through the medium of the circulation, is absorption by the lungs.

The experiments of Dr. Rousseau, already noticed, are sufficient to prove that some volatile substances are very rapidly absorbed by the lungs, and taken into the course of the circulation. There is no reason for supposing that any decomposition of the medicines occurs in these instances. Although the air is

* Traité Element. de Matière Medicale, vol. i, p. 60.

the vehicle by which these substances are conveyed into the lungs, and although it undergoes a chemical change in the bronchial cells, yet, this does not affect the volatile matters held in solution by it when it is inspired: these are taken up by the absorbents opening on the mucous membrane of the bronchial tubes; whence they are carried into the circulation, and again excreted by the kidneys and the skin. In their passage, they powerfully stimulate the nervous system, and, occasionally, produce as decided an influence on the body as if they had been taken into the stomach.

The difference between the mucous membrane of the bronchial tubes and the skin or cutis, consists in the medium interposed between them and the air: in the skin this medium is the epidermis; in the lungs it is a fine epithelium, which certainly is more likely to permit imbibition than the epidermis. It is possible that, in this manner, and not, strictly speaking, by vascular or lymphatic absorption, some volatile matters admitted into the lungs are conveyed into the system.

4. ACTION OF MEDICINES DECOMPOSED EITHER IN THE STOMACH, OR AFTER ENTERING THE SYSTEM.

The decomposition of medicinal substances may take place in the stomach;—or in the blood;—or in some secreting organ.

1. A medicine may be decomposed in the stomach, and one or more of its constituents be detected in some part of the system; or in one or more of the excretions: or a medicine, thus decomposed, may act on the nervous system by one or more of its constituents.

The first of these positions is demonstrated when some substances containing colouring principles are taken into the stomach. Thus, if a few drops of Liquor Potassæ be added to the urine of a person who, a few hours before, has swallowed a dose of Rhubarb, a lake colour is produced, shewing the presence of the colouring matter in the urine: and if madder be mixed with the food of an animal, the colouring matter will be found deposited in the bones. Many odorous substances, also, yield their odoriferous principle to the blood, whence it is separated by the kidneys, and can be detected in the urine.

With respect to vegetable medicines especially, their decomposition is effected in the same manner as that of alimentary substances. Many experiments have ascertained the fact, that all simple aliments, such as *albumen*, *gelatin*, *fibrine*, *caseous* matter, *vegetable mucus*, *sugar*, *starch*, and *gluten*, are soluble in the gastric juice*; and that all compound aliments, containing

* The experiments of Dr. Beaumont on St. Martin have incontrovertibly determined the existence of a gastric juice; and also its solvent power.

these substances as constituents, are also dissolved by it, under certain conditions connected with the structure of the compound substances. A substance, for instance, the components of which are, when separate, readily soluble in hot water, is very quickly dissolved in the gastric juice. It is less quickly dissolved if the components, separately, require the assistance of acids for their solution; as those, for instance, which contain much *gluten, concrete albumen, fibrine*, and *caseous matter*: and the gastric juice scarcely acts at all upon the *husks of grains*, the very *hard fibres of woody plants, hairs, feathers*, and substances of a very compact texture. Now, as all vegetable substances are components of some of these simple aliments, and are more or less susceptible of solution in the stomach, it is evident that all vegetable medicines must undergo digestion to a certain extent: although it is probable that some of them previously act upon the nerves of the stomach. The decomposition, however, is, in most instances, first effected, and the active principle, being thus extricated from the digestible matter, operates either *directly* upon the nerves of the stomach, or escapes into the circulation. It is to this circumstance that we may ascribe the time which elapses after swallowing some medicines, and the period when their operation becomes apparent. Thus, if a full dose of the powdered root of Ipecacuanha, or the seeds of Strychnos *Nux-vomica*, be swallowed, from ten to thirty minutes generally elapse before the influence of the *Emetia* or that of the *Strychnia* be displayed—a circumstance which we may fairly attribute to the envelopment of these active constituents in the *Wax, Gum, Starch*, and *ligneous* matter of the powders, so that they cannot exert their influence until extricated from these by the process of digestion. The decomposition of medicines in the stomach is not, however, confined to vegetable matters; the Acetas Potassæ, and some other salts, are liable to undergo the same process; the acid is digested, whilst the alkali passes into the circulation, and is excreted unaltered by the kidneys. Whether this may be ascribed to a galvanic influence exerted by the organic agent, deserves consideration. Be this as it may, it is evident that the decomposition is effected by the vital powers of the stomach; and that the active principle of the medicine, thus eliminated, either acts *directly* upon the stomach, extending its influence by nervous sympathy to distant parts of the system, or it is absorbed and carried, in the course of the circulation, to those organs on which its appropriate action becomes apparent, whether *diuretic, sudorific, expectorant*, or otherwise.

These remarks are not at variance with the fact, that medicines taken into the stomach are also decomposed by chemical means. The acids existing in the stomach are chiefly the

Acetic* and the Hydrochloric or Muriatic; and the quantity of these is more or less augmented by the condition of the stomach, and the stimulant quality of the food. Pepper, or any spice, for example, greatly increases the secretion of these acids. Many morbid causes, particularly those which augment the irritability of the stomach, increase also the secretion of these acids; and, from their superabundance, they become prominent symptoms of that diseased state of the digestive organs which constitutes *Dyspepsia.* If, during this condition of the stomach, any alkaline Carbonate be swallowed, a chemical action immediately takes place in the stomach between this Carbonate and the acids of the gastric juice; the Hydrochloric acid, having a greater affinity for the alkaline base of the Carbonate than the Carbonic acid has, unites with that base, and, setting free the Carbonic acid in a gaseous state, forms a new salt with the base of the Carbonate. In this instance, the chemical decomposition of the medicinal substance is effected exactly in the same manner as in the laboratory of the Chemist, at a temperature equal to that of the living stomach; one of the components (the Carbonic acid) is immediately rendered active; whilst the new compound, produced by the union of the alkaline base with the acid of the stomach, the Hydrochloric, or with the Acetic if present, varies in its operation according to the chemical nature of the Carbonate employed. If the alkaline base be *Soda,* the new salt generally passes out of the stomach undecomposed, and operates as a purgative; if *Potassa,* and an Acetate be produced by the chemical process, this is again almost immediately decomposed by the digestive function: the acid mingles with the chyme; whilst the Potassa, eliminated, is taken into the circulation, and, being carried to the kidneys, stimulates these organs to increased action, and promotes the secretion of the urine. Whatever is the base of the saline body employed, the Carbonic acid always plays the same part, producing a direct tonic impression upon the stomach at the moment of its extrication: whilst the base passes into the circulation; and illustrates the fact, that a medicine may be decomposed in the stomach, and operate by one or more of its components.

2, 3. A medicine may be absorbed entire, and be afterwards decomposed, either in the course of its circulation in the blood-vessels, or in some particular secreting organ, and operate on the nervous system by one or more of its components.

This proposition is by no means so easily demonstrated as the former, although there are results following the administration of some medicines which can only be explained on the

* Dr. Prout believes that the Acetic acid, when present, is always derived from the aliment.—*Phil. Trans.* 1824.

supposition of a decomposition, such as it describes. If Mercury, for example, in the state of an oxide, be taken into the stomach, or introduced by any other means into the system, the medicine is first absorbed, undecomposed, into the circulation; but, after some time, according to the state of the habit of the body of the person employing it, as soon as its constitutional influence is perceptible, it appears to be decomposed in the system. Gold, carried in the pockets of the person taking Mercury, becomes whitened in the same manner as if an amalgam were formed by rubbing metallic Mercury upon its surface. It is true, that although this proves that the Mercury escapes from the body through the exhalant pores of the skin, yet, it does not inform us of the state in which it is thrown out; or whether it have suffered reduction, and is exhaled in the state of mercurial vapour. But if direct experiments are insufficient to satisfy our enquiries on this point, the fact that metallic Mercury has been detected in the bodies of those who have died*, after being fully under its influence, affords some ground for supposing that the mercurial preparations employed as medicines, unless they quickly pass off by the bowels, are decomposed either in the course of the circulation or in the secretory organs; and if this be actually the case, it is probable that they operate, not in their entire state, but by one or more of their components. This reasoning is also supported by phenomena attending the employment of the preparations of some other metals; more especially the Nitrate of Silver, a salt composed of Oxide of Silver and Nitric Acid. If this salt be internally administered in small doses, it produces a powerful tonic effect upon the system; and, in some instances, when it has been taken for some time, it leaves a permanent tinge of a leaden hue upon the skin. Now, it is evident that this effect could not take place if the Nitrate of Silver were not taken into the circulation in an undecomposed state; for, if the Nitrate were decomposed in the stomach, and converted into Chloride of silver, this is an insoluble salt, and, consequently, not fitted to be taken up by the absorbents. But if we admit that the Nitrate of Silver is taken into the circulation in its undecomposed state, we can readily explain the manner of its decomposition by the capillary vessels of the skin, and its deposition in the rete mucosum, in the state of an insoluble Chloride, which would necessarily render any tinge communicated by it to the skin, permanent; thence the leaden hue of the complexion which has unfortunately, in several instances, followed the administra-

* The authors who have borne the most accurate testimony to this fact are Fallopius, de Morbo Gallico, c. 76; Johannes Fernelius, de Luis Vener. Cur. c. 7; Mayerne, Praxis, l. i, c. 8; Wepfer, de Apoplexia, p. 303; Fontanus, Resp. et Cur. Med.; Lentilius, Miscell. Med. pr. vi—i, p. 74; and Mr. Brodlelt, Mem. of Med. Soc. of London, vol. v

tion of Nitrate of Silver. From these facts, there can be no doubt that there are medicines, which, after being taken into the circulation in an entire state, are decomposed in their progress through it.

5. REVULSIVE OR COUNTER-IRRITANT ACTION OF MEDICINES.

The influence of new diseased actions—for instance, those produced by cutaneous eruptions—in relieving even inveterate functional diseases, is familiar to every one who has observed the effects of either the therapeutical efforts of the constitution, or of the means employed by the physician. Medicines also operate in this manner, and change the seat of irritation, setting up, as it were, a new centre of morbid perceptions; and, according to the law of the system, by increasing the sensibility of one part, diminishing that of the neighbouring parts. In this change of action, the blood is directed in greater quantity to the part acted upon; or, in the language of the ancients, a *revulsion* is produced.

The beneficial effects of many medicinal agents can be readily explained upon this principle; as, for instance, those of rubefacients, vesicants, and escharotics: thus, an incipient inflammation of the tonsils is often rapidly removed by the application of a liniment, composed of Ammonia and a fixed Oil, to the fore part of the neck: an attack of gout in the stomach, by the application of boiling water to the pit of the stomach: and deep-seated pains, by the operation of caloric in the form of the actual cautery. But the benefit of counter-irritant action is not confined to external applications. The advantages derived from the use of purgatives in affections of the head and chest are justly referred to their counter-irritant influence: even sudorifics and diuretics operate as revulsives, and the benefit derived from their employment is the result of the same counter-irritation, set up on the skin, and in the kidneys.

This mode of action is employed for one of two purposes: either to change the irritation or excitement from the internal viscera to the skin; or to transfer it from the viscera of one cavity to those of another. But much caution is requisite in the employment of this description of medicinal action: it may augment the general excitement to a degree sufficient to aggravate rather than to diminish the disease for which it is employed. Thus, as I shall particularly prove, in treating of vesicants, the application of blisters so considerably quickens, and so much increases the force of the general circulation, that they are unfit remedies in the early stage of extensive acute inflammation. It is, however, necessary to distinguish between this state of excitement and that general irritability of the system which is

2. EFFECTS OF AGE IN MODIFYING THE ACTION OF MEDICINES.

The effects of age upon the form and functions of the animal body are sufficiently striking. In some of the lower animals in particular, the changes that take place cannot be overlooked by the most cursory observer. Thus, the Pea-hen and the hen Pheasant acquire the plumage of the males as they become old. The various states of the human body, also, at different periods of life, display striking characteristic changes; but it is unnecessary to notice, in this place, any of those which do not exert some considerable power in modifying the operation of medicines.

In infancy, the general susceptibility of impression, and the mobility of the frame, are greater than in adult age, as demonstrated by the production of convulsions from the irritation of teething, and the irritation of the bowels by crude or indigestible food. The blood circulates, also, more rapidly in childhood than in the after periods of life, as indicated by the pulse, which is generally forty or fifty beats quicker in the first year of any person's age than at the period of puberty. In the newly born infant, the pulse is usually one hundred and forty in a minute: before the first year is completed, the pulsations at the wrist are seldom less than one hundred and twenty in the same space of time: after the first, and before the termination of the second year, they are reduced to one hundred: between the second and fourth, to ninety-six: and at puberty to seventy. Were we to hazard an attempt to explain this greater energy in early life, we might refer it to the intention of Nature at this period, being the building up of the frame. In the growth of the body, the supply of vital stimuli must be greater than the waste; consequently, the excitement almost amounts to a condition of fever. This, however, gradually lessens as that period advances when the bodily frame is perfected, and an equilibrium between the supply and the waste is established. Many other changes, also, take place in the progress towards the full maturity of the bodily powers.

As the period of puberty advances, the system, in both sexes, undergoes a remarkable change. In the male, the beard appears, the voice becomes more grave, the mind less vacillating, and the whole corporeal functions are performed with greater vigour and constancy. In the female, the menstrual discharge shews itself, the bosom enlarges, consenting with the change in the functions of the uterine organs. The mental character is not less altered than in the male. In both sexes, as soon as the reproductive organs are adequate to their functions, the sexual

appetite is awakened, and all the powers of the body and the mind ripen into full perfection.

If we trace life forwards, we find the vigour of the corporeal frame gradually declining after a certain age: the animal heat lessens with the diminished energy of the nervous system: the power of the heart is weakened; the pulse, seldom, even in the healthy state, exceeding sixty beats in the minute: many small vessels become impervious, owing to the blood not reaching the capillaries, consequently the surface appears dry and wrinkled: menstruation has already long ceased in the female, and the sexual appetite gradually declines in the male. The proportion of the fluid components of the body, both general and partial, is diminished; and their character, chemically considered, is altered. The fibrin and phosphate of lime is augmented, whilst the gelatin is lessened and changed in quality. There is also a less proportion of lymph in the cellular tissue, so that the lymphatics shrink. Finally, all the excretions contain more solid matter, and are more acrid than in youth and manhood.

In these different periods of life, it is not surprising that the same medicines produce very distinct effects. In childhood, when the absorbents act feebly, much larger doses of Calomel can be borne with impunity than in adult age: but, owing to the greater susceptibility of the nervous system, full doses of Narcotics cannot be administered without the greatest hazard. In infancy, also, the acescent state of the stomach modifies greatly the action of some medicines, rendering those acrid and severe in their operation, which are mild in other conditions of the digestive organs.

But as it is not, strictly speaking, the age of the patient, so much as the alterations in the state of the system, at the different periods referred to, which influence the operations of medicines, these must be attended to at whatever time they happen. Marks of puberty have, sometimes, displayed themselves at a very early period. Many remarkable instances of this are recorded. Pliny* mentions a boy of Salamis who had attained puberty at four years of age. Craterus is stated to have seen a person whose span of life did not exceed seven years; nevertheless, in that period he had attained adult age, had been a father, and before death displayed all the marks of old age†. At Willingham, near Cambridge, a boy of the name of Hall died in 1747, in whom all the signs of virility were apparent when he was a year old; and, before he was six years of age, he died with every symptom of advanced age‡. Several other instances might be quoted. In the female, also, instances of premature

* Hist. Nat. l. vii, c. xvii. † Phlegon. de Mirab. c. xxxii.

‡ See Phil. Trans. 1744—5.

puberty have occurred*. Menstruation has been known to continue to the seventieth year. In all these instances, either of premature puberty or of a protraction of the menstrual discharge long beyond its usual period in females, the same rules regulate the operation of medicines as if those conditions of the habit occurred at the ordinary periods: these variations, therefore, must be kept in view, both in prescribing and in reasoning upon the effects of remedies.

3. EFFECTS OF SEX IN MODIFYING THE ACTION OF MEDICINES.

The differences in external conformation and in the strength of the bodily frame, which distinguishes the sexes, are sufficiently obvious to the most casual observer; but there are, also, functional distinctions less evident. Both are likely to influence the operation of medicines.

In children, the general figure of the body is scarcely distinctive of the sexes; but the distinction becomes more and more obvious as the age of puberty advances; when the muscular, robust figure of the youth is strikingly contrasted with the delicacy, softness, and comparatively diminutive stature of the maiden. In the osseous system, the cylindrical bones of the female are more slender, the flat bones thinner, and all are smoother than in the male. In the muscular system, the fibres are paler, less dense, and, consequently, weaker: and, with the exception of the glutei, the psoæ, and a few others, the muscles are proportionably smaller. The skin of the woman is more delicate than that of the man, and whiter, owing to the large quantity of fat deposited beneath it, filling up the interstices between the muscles, and producing that beautiful roundness which is characteristic of the sex. Except on the head, on which the hair is commonly in greater quantity and longer in the woman, the parts of the skin covered with hair in men, are either entirely devoid of this appendage, or less hairy, or covered with a delicate down, in women. The capacity of the abdomen and that of the pelvis is greater; but that of the thorax is less in the woman than in the man.

Such are the chief distinctions in the conformation of the frame in the two sexes. Among the functional differences, we may observe, that the female body is more excitable than the male. The circulation is carried on more rapidly; and the pulse is, cæteris paribus, more frequent in women than in men: the growth of the body is, therefore, in general quicker; puberty and adult age occur earlier; and, when the former arrives, the proportional quantity of blood passing to the abdomen is

* Medico-chirurg. Trans. vol. xi. Gall sur les Fonctions du Cerveau, p. 260.

greater. The nervous system of females is more mobile and susceptible of impression: consequently, they display more sensibility both of body and of mind than men.

But the chief distinction between the sexes is undoubtedly displayed in the functions of the genital organs. In the male, at the age of puberty, the new action taken on by the testes is accompanied by a corresponding change in the whole system: the susceptibility of the nerves is greatly augmented; and this is powerfully excited by the sexual appetite, which is now first awakened. Much of the future condition of the system depends on moderating the influence of this passion: its abuse is soon followed by permanent languor, sometimes by nervous apoplexy. A much more serious consequence, however, results from the excitement of the generative organs without sexual communication: the degree of languor and debility is greater than that which follows the act of coition; the whole nervous system becomes morbidly susceptible of the slightest impression: and a violent paroxysm of mania is a frequent result of the indulgence of this propensity.

In the female constitution, the commencement of the functions of the uterine system produces changes of a magnitude and importance much greater than those connected with puberty in the male. The menstrual discharge, which, in this climate, commences about the fifteenth year of the age of the maiden, is usually preceded by sensations of plethora and fulness in the head, heaviness in the chest, tension in the loins, and lassitude of the limbs. After it has taken place, and is fairly established, the energies both of the body and the mind seem to have received a fresh impulse: the eyes brighten and swell with moisture; the cheek is spread with a fresher bloom; tho voice is more harmonious; the hips and breasts expand and enlarge; the movements and attitudes of the young female become more graceful; her mind ceases to engage in childish pursuits; and, as in the youth, those desires are awakened which have been implanted in our nature for the continuance and the increase of the species.

The effect of impregnation on the other functions of the female system are still more striking. The blood is sent in greater proportion than usual to the mammæ and the uterus. At this time, also, the vascular system of the female takes on an inflammatory or febrile action; the blood, when drawn from the veins, displays that appearance, characteristic of inflammation, which is called the buffy coat; the stomach becomes highly irritable; the countenance appears altered; the eyes seem larger, the mouth wider; and every feature is sharpened. Giddiness, dimness of vision, palpitations of the heart, vomitings, great inquietude, and, occasionally, convulsions, are the symptoms indicating the increased nervous susceptibility of the

whole frame. Even the temper is often changed, and the gentlest, the most amiable of the sex become impatient and irrascible, to a degree sometimes almost bordering on Insanity, which, in those hereditarily disposed to it, is easily roused, in this condition of the female system. After parturition has taken place, and the womb, having relieved itself of its burden, has returned to its ordinary condition, the secretion and excretion of milk maintain a state of the habit considerably different from that which is natural to the female who is not performing the duties of a mother.

It is necessary to examine in what manner those conditions of the habit, depending on sex, exert a powerful influence in modifying the operation of medicines. In a youth just arrived at the age of puberty, when the nerves vibrate to every impression, and the blood circulates with an almost febrile rapidity; when the muscles are strung, as it were, to their utmost tensity, and the mind is elevated to the highest pitch of enjoyment; if any thing occur to bring on disease, medicines will produce effects different from those that follow their administration in another condition of the body. In prescribing, therefore, even for a male patient, at this period of life, the influence of sex in modifying the operation of medicines is not to be overlooked.

In the female, whatever may be the cause of that periodical determination of blood to the uterus which is termed menstruation, or whatever may be its ultimate intention, its presence or its absence produces a very considerable difference in the operation of the same kind of medicines. In pregnancy, also, the remedies which relieve disease in females who are not pregnant, cannot always be employed with safety. In the unimpregnated female, the irritable state of the stomach, which is accompanied with heartburn and vomiting, may be judiciously managed with sedatives; such, for instance, as the Hydrocyanic acid, or the solution of Potassa; but, in the pregnant state, much injury may accrue to the unborn infant from its administration. Opium, also, when given in large doses, if frequently repeated, for the relief of cramps or inquietude in the mother, is ultimately injurious to the fœtus. To the mother, also, these medicines may prove hurtful, from their action being modified by the disturbed state of the functions of the brain, which so often occurs during the period of pregnancy. For the same reason, some stimulants which may prove highly beneficial in palsy, in the ordinary state of the body, often increase the complaint, and even tend to produce a fatal termination of that affection, in the pregnant female. Indeed, no violent medicines can be safely prescribed for a pregnant female.

In the nursing female, the course of the circulation is different from that in the virgin and in the woman who is not nursing. The blood is sent to the breasts in much larger quantity in a given period; the uterine functions are suspended;

menstruation rarely occurs; and impregnation seldom takes place at this time. As the breasts also become excretory organs in this condition of the habit, the exhalant function of the skin, and the excretory of the kidneys, are necessarily greatly diminished: whilst the absorbents act more powerfully: and thence, the female who has an abundant supply of milk, becomes thin in the direct ratio of the quantity. In this state, those medicines, which, in females who are not suckling, pass into the circulation, and are thrown out of it by the kidneys, are found in the urine in much less quantity than usual; and, therefore, it has been presumed that they are excreted by the mammæ, and *might* be detected in the milk. That odorous substances enter the milk, is well known by the peculiar smell and flavour communicated to it, in the cow who is fed upon decaying turnip-tops and grains. The presence of sulphuric acid and salts of Mercury has been detected in the milk of women; but I am not aware of any experiments that have detected in the milk, either *Alkalies*, the colouring matter of *Rhubarb*, or *Iodine*, or *Borax*, or *Nitrate of Potassa*, or any other substances, the presence of which has been detected in the urine; nevertheless, it is not impossible that they may be found in the milk after they have been taken into the stomach of a nurse; and, therefore, some caution is required in prescribing, for nursing females, medicines which are of a nature likely to injure the health of the child, in the event of their being absorbed and carried into the circulation of the mother. Were the medicines numerous which are thus absorbed and excreted by the mammæ, an easy and safe method of acting upon the infantile system, in many diseases, would be afforded.

4. EFFECTS OF CUSTOM IN MODIFYING THE ACTION OF MEDICINES.

Nothing is more remarkable than the influence of *Habit* or *Custom* over both the *mental* and the *corporeal* functions in man: its control over the action of medicinal substances is not less wonderful, and, therefore, it is necessary to examine the manner in which it operates.

There can be no doubt of the distinct existence of the *Soul* or *Mind*—an essence which exists independent of organism, which, in every form and state of the body, in deformity, in defectiveness of parts, in disease, in age, in the almost total wreck of the corporeal frame, displays itself entire and unimpaired, triumphing over the frailties of our grosser nature. But, in admitting this truth, we must also admit that the mind is so intimately connected with the animal functions—those of the *brain*, of the *spinal cord*, and the *nerves*—that, without these parts of the frame, it has never displayed its energies, and every *idea* is

thence necessarily preceded by and dependent upon some corporeal change; nevertheless, the immediate cause of the *idea* thus excited, is, in every instance, an affection of the immaterial mind. The brain is the organ or instrument by which the mind operates*; the nerves are the means by which the intentions of the mind are executed; and they are, also, the media of connection between the mind and the exterior world. Stimulants applied to the body produce, by the impressions which they make upon the nerves, certain effects which the mind perceives or takes cognizance of; and thus it becomes furnished with *ideas*. As these impressions, however, are not all alike, either as regards intensity or kind, *Memory*, or the principle of previous association, operates to retain and recall the marks of those already perceived, and *Judgment* to compare and examine their relations with those which are new or are to come. By means of these two faculties of the mind, therefore, man becomes fully acquainted with the external world, and exerts his influence over it. Now, it might be supposed that as long as the organs of the *senses* and the mental faculties remain entire, Reason could not err in deciding upon the evident qualities of objects of sense, those in particular which we perceive by *touch*—as, for example, *figure*, and whether a body be *hot* or *cold;* or those which we examine by our muscular frame—*hardness*, *softness*, and *ponderosity*. But even over this decision, habit exercises a powerful control, and often leads us to pass a judgment contrary to the conviction of our senses. A striking illustration of this was displayed in the person of the late Dr. Wollaston. When Potassium was first shewn to him, he placed it upon his finger, and, after poizing it for a few seconds, remarked, "yes, among the other attributes of a metal, it has also ponderosity." This influence of habit upon the judgment modifies the operation of medicines, occasioning frequent disappointments to the physician, who, nevertheless, may sometimes take advantage of it for the benefit of his patient.

The immediate control of habit over the body is still more evident than its influence on the mind. Its power in diminishing the sensibility of the nervous system has been frequently observed; and it is well illustrated by a fact mentioned by Boerhaave, that when Hungary water was much in vogue, many women in Holland lost their sense of smell by the too great use of this water. But it is more difficult to explain how the vital or organic functions, those which, in the ordinary condition of the healthy body, are independent of the will; namely, the circulation of the *blood*, *respiration*, the evolution of animal heat or *calorification*, *digestion*, *nutrition*, and *absorption*, are influenced by habit: but the fact is undoubted. In an individual who is unaccustomed to take exercise, the cir-

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* Seelenorgan. *Rudolphi.*

culation is quickened by every slight exertion; but, if the person daily exercise himself, this effect ceases to follow even a much greater effort. In respect to the respiration, the power which pearl divers possess of remaining under water is truly astonishing. No man who has not been trained to diving can live under water, when the respiration is completely suspended, for more than half a minute, unless fainting have previously taken place, in which case the submersion can be sustained for upwards of a minute with impunity. The power of remaining two or three minutes under water is, nevertheless, frequently acquired by the oldest divers, in the bay of Naples, and proves in a remarkable degree the influence of habit. We have also daily instances of the body acquiring the power of supporting very high temperatures. Not to mention the individuals who have occasionally exhibited themselves, we may refer to the writings of Du Hamel, who mentions, among other instances, that the young female servant of a baker at Rochefoucault had acquired the habit of resisting heat so effectually, as to go into an oven heated at 276°, and to remain in it for twelve minutes. In general, the hot bath cannot be borne at a higher temperature than 106°; but the Russian, who is in the daily habit of using it, can support it at 116°; and when vapour is employed instead of water, habit enables the Russian to bear it as high as 160°. The same power enables cold to be sustained without danger. Thus, we see women of the most delicate frame, with the shoulders and chest exposed in a manner that could not be borne without great risk by the strongest men unaccustomed to it. The male peasants in the north of Europe go with their bosoms bare in the coldest winter weather; and the companions of Captain Parry in his voyage to the North Pole, after some time, used to walk on the shore when the thermometer was 49 degrees below Zero. With regard to digestion—the Siamese are fond of rotten eggs, and digest them readily; although I need scarcely say, that nothing would be so likely to disorder the stomach of any one who has not acquired the habit of relishing such food. In this manner we might trace the influence of habit over every vital function.

In modifying the direct effects of medicinal agents upon the body, the power of *habit* is equally conspicuous. If the same medicine be daily administered for some time, instead of being followed by the result which at first displayed itself, the system remains either unsusceptible of its impression, or becomes highly susceptible of it: and yet, the properties of the medicine remain unimpaired, and the condition of the parts upon which it acts remains also apparently unchanged. This is rendered evident by substances which have lost their influence upon one part, displaying it fully when applied to any other part; for example, the substance which has ceased to act on the stomach will still operate briskly if administered as an Enema; and, in reference to

the condition of the parts remaining the same, this is illustrated by the fact that it will not require a larger dose of Arsenic to destroy an opium-eater than any other person. Poisons are rendered inert, if their administration be carefully regulated, by commencing with small doses, and daily augmenting them, watching their effects, lest the increase should be too rapid. Many persons have thus brought themselves to swallow Opium in large quantities without experiencing its narcotic effects. I have known instances in which two drachms of solid Opium, or five fluid ounces of Laudanum, have been taken in twenty-four hours; yet the same individuals could not have swallowed many grains of it without danger when they commenced the baneful use of the drug. In the same manner, also, habit renders the nerves of smelling callous to some odours, while they retain the greatest susceptibility to others. Thus, Baron Haller was not at all affected by the stench of a dissecting room, yet he was peculiarly sensitive in distinguishing, even at a distance, a fœtid perspiration, when it was scarcely sensible to any other person. If we attempted to account for the effect of habit in the instances just described, by saying that the repeated application of the same stimulus to the body diminishes its power on the sentient extremities of the nerves, owing to these retaining for a certain time the change which the impression of the stimulus produces—and, therefore, the application of the same substance, unless in greater quantity, becomes incapable of altering this condition, but rather confirms it—thence the repetition of the impression will ultimately cease to produce any effect, even in degree—what do we say more than merely state the fact? We do not advance one step in raising the veil which obscures the cause from our perception. The knowledge of the simple fact, however, is sufficient for our purpose; it convinces us of the power of *habit* in modifying the operation of medicines, independent of the mind; and it demonstrates the necessity of inquiring into the habits of a patient previously to prescribing any medicine from which much is to be expected. Thus, if a person, who is in the habit of taking Opium in large quantities, is labouring under a disease in which pain and watchfulness are symptoms, although it would be useless to prescribe Opium, yet the indication may be answered by a moderate dose of another narcotic. Illustrations of this fact more frequently come under the observation of the physician in reference to purgatives and some other classes of remedies than to narcotics. In persons, for example, who are in the custom of taking pills composed of Colocynth and Aloes, or similar articles, the largest doses of these purgatives occasionally fail, under disease, to produce the action of the bowels; whilst a dessert spoonful of Castor Oil, or a teacupful of Sea-water, will produce copious and numerous evacuations.

In stating these facts, it must also be mentioned that habit

does not always lessen the susceptibility of impression to the same stimulus; for this results from those stimuli only, with the exception of a few, the action of which falls short of inflammation. A man may take a large quantity of diluted Alcohol, day after day augmenting the quantity, and yet scarcely feel its effects; but one glass of pure Alcohol would produce inflammation in the stomach, which would be farther increased by a repetition of one-tenth of the original dose. No habit can reconcile the body to impressions which at first produce a state of disease. They are exceptions to the general rule, and, instead of producing a diminished effect by repetition, have their influence augmented. This augmentation of effect, however, is extremely irregularly displayed: a fact which is well illustrated by the diminution of effect which follows the administration of large doses of Tartar emetic: after the second dose, it usually ceases to vomit. It is, also, demonstrated in another manner during the use of Castor Oil. After this medicine has been taken for some days regularly in the full dose, the quantity may be gradually diminished without impairing its effects, until, from six drachms, the dose is decreased to as many minims. In prescribing Castor Oil, therefore, in cases of habitual costiveness, we must ascertain whether the patient have been in the habit of taking the medicine; as the dose which would, in ordinary cases, be a very moderate one, might, in the instance of a person habituated to the use of the medicine, prove of serious disadvantage.

On account of the influence of habit, it is often necessary to suspend for a short period the use of a medicine; so that, when it is again employed, the impression may be renewed with sufficient energy.

5. INFLUENCE OF CLIMATE ON MAN, IN MODIFYING THE ACTION OF MEDICINES.

The influence of climate, in modifying the action of medicines, operates by the change which it causes in the animal frame: whether that be temporary or permanent.

Man is the only animal that can live in any climate: but, although he can live, yet, changes are effected on his frame and constitution of the most striking kind, by removal from one part of the globe to another part; and these are not only temporary, but they are continued through many generations, constituting the varieties of the human race. In employing the term *varieties*, it is right to mention, that naturalists are divided upon this question. Some, among whom is the justly celebrated Buffon, make one species only of man; others maintain that there are several species; whilst a third set, steering a middle course, suppose that, although there be not distinct species, as of the lower

animals, yet, that there are distinct *races*. The most celebrated of modern naturalists, M. Cuvier, maintains the last of these opinions*: indeed, every fact in the history of mankind, with which I am acquainted, tends to confirm the belief, that *man is of one species*, and that the *whole* of the human genus is descended from the *same original parents*. The proof of this may be deduced from the agreement of the traditions of almost all countries concerning the birth place of the first parents of our species. Moses fixes it in the south of Asia; the Hindoo traditions state that their progenitors came from the north-west; the Scandinavian, that theirs travelled from the south-east; and the Chinese assert that their ancestors came from the west; all concurring to fix on the spot pointed at in the Mosaic writings.

It might be very plausibly asserted, that man came perfect from the hand of his Creator; and that the *races* and *varieties* of the species are the result of various causes operating a *degeneration*, or *deviation* from the original standard. Before proceeding, it is proper that the meaning of the words *race* and *variety* should be clearly understood. *Kant*, the German Metaphysician, regards the term *race*, as strictly applicable only to a character produced by degeneration, and such as to become, by propagation, necessarily and inevitably *hereditary;* as, for instance, the sexual intercourse of a *white* man with a *Negro* woman produces a distinct race, the *Mulatto:* on the contrary, the term *variety* is applicable to such variations as occur when *fair* individuals, connected with *brunettes*, propagate *dark-eyed* children. When *races* have been continued through a long series of generations, they almost acquire the fixed characteristics of distinct species; and it is this which has involved the question of the human family in so much obscurity. The cause of the degeneration spoken of, are chiefly *climate*, *food*, and the *modes of life* of associated mankind. Thus, if the tall and symmetrical *Georgian* be transported to the *Arctic* circle, in a series of generations his progeny would dwindle into the diminutive and stunted *Esquimaux;* in the same manner as the noble tree, spreading forth its luxuriant branches in the valley, appears of dwarfish stature and little more than a shrub when its seed, carried by the wind, or from other accidents, vegetates on the heights of the mountain. The proofs which support the opinion of the mono-species of mankind, besides being derived from Scriptural History, are supported on the physiological characters common to all the races; on the facility with which these pass into one another; on the power of the mixed progeny of any two of the races to propagate; and on the diversities of the races being in all respects analogous to those deviations from a

* Le Regne Animal, t. i, p. 81; ed. 1817.

common type which mark varieties in the progeny of a single race. It is, nevertheless, probable, that the changes which constitute the races are not altogether accidental; but that there is, as Dr. Prichard remarks, "an *intentional* relation to *climate* in the distribution of the different races." It is in the form of the head or skull, that these distinctions are chiefly observable: thus, the great breadth of the head in the Asiatics, compared with the narrow flattened head of the Negro, and the oval skull of the European, is obvious to the most cursory observer; and upon this feature, some philosophers have attempted to arrange all the races of the human species. Blumenbach, following Lacepede, makes five distinct *races*, the limits of each of which can be easily traced upon the map of the world. Two of these races, however, may be regarded as varieties of the other three: in noticing them, I will not enter into the peculiarities that distinguish each, beyond a general outline.

1. The *Caucasian*—named from Mount Caucasus, in the neighbourhood of which the Georgians and Circassians, the finest races of man, are found—is distinguished by the skin being white and the cheeks florid; the hair long, soft, and undulating, varying in colour, from a nut-brown to the deepest black; the head nearly globular, with the forehead moderately expanded; the cheek bones narrow; and the front teeth of each jaw placed perpendicularly; the face oval; the nose narrow and prominent; the mouth small; the lower lip turned out, and the chin round. This variety is supposed to be the standard of the human race; and some authors have devised means of determining its perfection. It comprehends all Europeans, except the Laplanders and the Finnish race, takes in the western Asiatics as far as the Obi, the Caspian sea, and the river Ganges, and the people of the north or Mediterranean coast of Africa.

2. The *Mongolian*—or Tartarian, marked by the skin being pale olive; the hair thin, black, stiff, and straight: the head square; the cheek-bones prominent; the eyes far apart, the eyelids half closed and apparently tumid, with the arch of the eyebrow scarcely perceptible; the osseous nostrils narrow, and the chin somewhat projecting; the face broad and flattened; the cheek projected outward and nearly globular; and the nose small and flat.

This race embraces the remaining Asiatics, except the Malays; it includes the Finnish races of the north of Europe; the Laplanders and the Esquimaux.

3. The *Æthiopian*—distinguished by the skin being brown, black, and yellow, and the hair black and crisp. The head is compressed laterally; the forehead arched; the cheek-bones are projecting, and the nostrils dilated; the malar fossa, behind the infra-orbitar foramen, is deep; the jaws are lengthened forwards; and the front teeth obliquely prominent, with the lower

jaw large and strong. The cranium is thick and heavy, and comparatively less capacious than that of the Caucasian race, as its cavity will not hold so much fluid as that of the skull of an European, by from four to nine fluid ounces. Thence it is maintained that the intellectual faculties of the African are less than those of the European, in proportion to the capacity of the brain; but such an opinion is not tenable. The face is narrow and projecting at its lower part; the eyes are prominent; the nose is broad and flat: the lips, particularly the upper lip, are thick; the chin is receding; and the facial line differs greatly from that of the Caucasian.

This race is spread over the whole of Africa, with the exception of the northern shores.

4. The *American.*—The skin in this race is of reddish-tan, or copper-colour; and the hair thin, black, stiff, and straight. The forehead is short; the cheek-bones are broad, arched, and round; the orbits are deep; and the cranium is light; the face is broad, with distinctly marked prominent cheeks; the eyes are deep-seated; and the nose is only moderately projecting.

It comprehends the Indians of the whole of the continent of America, except that portion which is occupied by the Esquimaux.

5. The *Malay*—is distinguished by the skin being tawny, or a clear mahogany, or chesnut-brown; by the hair being black, soft, curled, and very abundant. The head is somewhat narrow; the forehead slightly arched: the parietal bones more prominent; those of the cheek flat; and the upper jaws projecting; the face is broader than that of the Æthiopian, but the features viewed in profile are more distinct; the nose is full, broad, and knobbed at its point; and the mouth is large.

It embraces the inhabitants of the whole of the islands of the Pacific ocean, of the Marian, Phillipine, Molucca and Sunda Isles, and of the peninsula of Malacca*.

This division of the Human Species into five Races, is ingenious, but it is liable to exceptions. The different races run so insensibly into one another, that it is impossible to mark out the exact boundaries of the commencement or the termination of any of them. I cannot avoid quoting a striking remark upon this subject from the works of Drs. Martius and Spix on the Brazils. " The physiognomy of the Chinese colonists was particularly interesting to us," observe these gentlemen in their account of Rio Janiero; " and was in the sequel still more so, because we thought we could perceive in them the fundamental lines which are remarked in the Indians." These they describe, and then add, " In comparing the Mongol physiognomy

* Cuvier acknowledges three races only: the *white*, or Caucasian; the *Negro*, or Æthiopic; and the *yellow*, or Mongolian. I prefer the division of Blumenbach.

with the American, the observer has opportunity enough to find traces of the series of developments through which the Eastern Asiatics had to pass, under the influence of the climate, in order, at length, to be transformed into an American." Indeed, to the attentive observer, in any part of the world, the characteristics of several of the races are often found in the same individual. There are many Europeans who closely resemble the African or the Mongol, in every respect except colour: nor is this resemblance of individuals of one race to other races peculiar to countries in which opportunities for mixing and crossing breeds exist; but it is observed also in those parts of the globe which are cut off, as it were, from all the rest of the world. Captain Cook, in his voyage round the globe, saw many nations of the Friendly Islands, who are of the Malayan race, with complete European faces; and some even with Roman noses.

These varieties are regarded as the effect of climate; by which is not implied merely the geographical locality in reference to the latitude on the surface of the globe, but the elevation also of that locality above the mean level of the surface of the earth. Temperature, in this respect, operates almost as powerfully as it does in the relative position of a spot as far as regards its proximity to the equator. The inhabitants of a region elevated a thousand feet above the level of the sea live in a very different climate from those who inhabit its margin; although both places may be in the same degree of latitude. Temperature, therefore, arising from the direct and the radiated beams of the sun, influenced by *latitude* and *altitude*, constitute climate. We feel all the varied degrees of temperature in passing from the equator to the pole; and we feel them also in ascending from the valley to the summit of a lofty mountain. It may be proper to state here, that the heat or coldness of a climate is generally determined by taking the mean annual temperature, not merely as displayed by the thermometer, but by the temperature of deep lakes, which is considered as indicating nearly the mean annual temperature of the latitude in which they are found. According to tables constructed by Mr. Kirwan, the mean annual temperature at the equator is 84° of Fahrenheit, that at the poles 31°, and that of London 52°; but the mean annual temperature is varied by many circumstances, such as vicinity to the sea, the elevation of the land, and culture; and thence the mean annual temperature of places, in the same latitude, differs. Thus, for example, New York, in North America, is in the same latitude as Lisbon; but its mean annual temperature corresponds to that of the North of Germany.

It is not easy to determine upon what other local circumstances those alterations, of which I have spoken in the human body, as produced by climate, depend: yet it is not altogether upon the temperature, even as far as colour is concerned; for

many facts may be brought forward to prove, that, after a considerable lapse of years, men who have migrated from the temperate regions of the earth to intertropical climates, have not become of so dark a hue as the natives of these countries. A race of Jews, which is known on the coast of Malabar by the name of white Jews, and who, from documents in their possession, appear to have emigrated to India soon after the destruction of the Temple of Jerusalem by Titus, in the year 490, still resemble European Jews in features and in complexion.

With respect to the influence of either casual or permanent varieties of the human species in modifying the operation of medicines, there can be no doubt. The slender and delicate Hindoo, who lives entirely on vegetable food; the Esquimaux, who gorges himself with the flesh of the seal or the blubber of the whale, until he is unable to move; the Otomac of South America, who, during the period of the inundations, appeases his hunger with unctuous clay; and the English yeoman, who satisfies himself daily with beef and porter to his heart's content; will all be variously affected by the same medicines. Dr. Smith says, "I think myself warranted by experience in remarking, that in negroes the system is not so easily brought under the influence of mercury as in Europeans*."

Climate effects a change of the constitution of the same individual, and thus the same medicine which influences him, in a certain manner in one climate, may affect him nearly in an opposite manner in another climate.

Dr. Davy, in his travels in Ceylon, states, from his personal observation, that, on first landing in a tropical climate, the standard heat of the body of a European is raised two or three degrees; and febrile symptoms occur, which require temperance, the avoiding every cause of excitement of the vascular system, and the use of aperient medicines. All authors, and indeed every observing person who has visited the torrid zone, agree that, along with the languor and exhaustion resulting from the high temperature of the atmosphere, there is a greatly increased mobility of the nervous system. The action of the cutaneous vessels in Europeans, who visit equatorial countries, amounts to disease, and produces that eczematous or vesicular eruption of the skin, known by the name of prickly heat. On the other hand, this function of the skin is so much weakened, almost paralyzed, when the climate from which a person is passing is dry and bracing, and that into which he has passed is humid and relaxing, that congestions of the blood take place in the larger vessels; the body becomes susceptible of the least impression of marshy exhalations; and agues and similar diseases are produced. It may be also mentioned, that the diseases of the

* Edin. Med. and Surg. Journ. vol. lvi, p. 158.

Torrid Zone are those of *irritability* and *sensibility* ; the diseases of the Frigid Zone are the reverse, arising from the deficiency of the stimulus of external heat, and a lack of *excitement* in the whole system. In this condition of habit, the powers of the stomach are impaired ; and, therefore, stimulants are taken with impunity. In the Torrid Zone, also, or countries bordering upon it, the peculiar currents of the air greatly affect the human system. The Sirocco, the wind which blows from the great Sahara or African desert, seems to leave behind it a portion of the *oxygen* of the atmosphere ; for, during the blowing of that wind, in Egypt, and even in Italy, fires do not burn well, the breathing of animals is oppressed, vegetation languishes, and so much debility is caused in man, that, during its continuance, the use of sedatives is absolutely prohibited.

Although man is the only animal who can live with impunity in every climate, yet this refers only to the adult, who has been nurtured to manhood in the climate peculiar to his race or variety of the species: his progeny, when he removes to another climate, may fall victims of the removal. Thus, the children of European parents, born in intertropical climates, seldom live to attain adult age if they remain in the country ; although, when one of the parents is a native, they do not suffer. I cannot avoid noticing, in this place, a curious fact recorded by Volney, the elegant historian of Egypt, that neither the Mamlouks, who were a *Caucasian* race, nor the *Turks*, who are Mongolians, unless they married native women, which the Mamlouks never did, could continue their race in Egypt ; all their offspring perishing in the first or second generation.

The effect of climate on the progeny of those who migrate to distant countries is well illustrated by many instances affecting our own countrymen. Thus, the Creoles of the West Indies, the inhabitants of the United States of America, and the settlers in New Holland and Van Dieman's Land, are all derived from the same English stock, and yet all their progeny differ from it in some particular feature. The *Virginian* and the man of *Carolina* are tall, lank, and gaunt ; the West Indian Creole is distinguished by a singular configuration of skull ; and, in New South Wales and Van Dieman's Land, the children of even diminutive European parents grow up tall and spare ; and, nevertheless, the natives are a short race of mankind. In moist climates, obesity and laxity of frame are induced—a fact which was very early observed. The influence of situation upon the state of the habit may, in some degree, depend also on the gravity or weight of the atmosphere, connected with locality. When the barometer is high, we feel vigorous and cheerful ; when it sinks, languor and low spirits oppress us. Asthmatics on this account, sometimes, breathe with more freedom in a dense atmosphere ; and, therefore, they find comfort near the sea.

Seeing the influence of climate in producing such alterations as those I have described on the aspect and habits of the human species, it will be easy to form an idea of the power which it is likely to exert in modifying the operation of medicines. The late Dr. Harrison found that *Narcotics* act with greater force, even in smaller doses, at Naples than in England. He instances the Extract of Henbane, which, in doses of three grains, thrice a day, in Naples, produced a temporary *amaurosis* or *nervous blindness*, which disappeared and recurred on the alternate suspension and administration of the medicine. This effect of the Extract was observed in two patients, who had often taken similar doses of the same remedy in England, without any unpleasant result—an effect which Dr. Harrison correctly refers to the increased nervous susceptibility of impression of the patients in the warmer climate; for there was no difference in the extract—that which was administered in Italy having been procured from London. Dr. Harrison found, also, that Nitrate of Silver and Nitrate of Mercury are more active in Italy than in England; and that, in general, the doses of medicines ordered in this country are too large for the climate of Italy. It does not, however, always follow that the doses of medicines require to be reduced in warm climates: on the contrary, in India, a scruple of Calomel and a grain of Opium are frequently administered, and repeated at short intervals, after depletion in dysentery; but few physicians would venture to prescribe this active remedy in such large doses in this climate.

The state of the weather and the season of the year will, sometimes, alter the operation of a medicine, in the same country. Thus, Dr. Annesley, in his work on the Diseases of India, informs us that, in the subsidiary fever of Nagpore, the Cinchona Bark, although it is the grand remedy in the cold season, yet, generally fails in the rainy season; at which time Calomel and Antimony prove beneficial.

The neglect of observing the effects of the influence of climate in modifying the action of medicines has led to many of the discordant accounts of remedies by different writers, and the rejection of some valuable medicines. Many medicines, also, have been unjustly depreciated, from having been administered at improper seasons of the year, or from no allowance having been made for the power of local circumstances over their action in the animal œconomy. In treating of the different articles of the Materia Medica, I shall have frequent opportunities of illustrating the truth of this remark. In prescribing for those who have lately arrived in a country of an opposite climate to that from which they have come, and who have not had time to be naturalized to it, the knowledge of the above-mentioned facts will be found useful. Thus, in the case of a person who has arrived in a hot from a cold climate, the susceptibility of impres-

sion being greatly augmented, the habit acquires a febrile tendency, and will not admit of the same doses of stimulant medicines that may be given with advantage to natives of the place, and to those accustomed, from long residence, to the climate. It is also a well-known fact, that persons, who have removed from the country to the metropolis, cannot bear the same loss of blood which they sustained with impunity before their residence in town, if they are suffering under acute inflammatory affections.

6. INFLUENCE OF MENTAL AFFECTIONS IN MODIFYING THE ACTION OF MEDICINES.

In examining the influence of the mind in modifying the action of medicinal agents, the questions—What is mind?—What is matter?—naturally present themselves to our attention. To reply to these queries involves enquiries of much difficulty, and uncertain utility; and to attempt to treat either of them metaphysically, would be out of character with the object of this work. Indeed, to venture to form any decision as to the real nature of either mind or matter, displays only that presumption which has always characterized attempts to resolve problems which from their nature seem placed beyond the grasp of human reason.

The first idea which we receive of matter is from *touch;* we are conscious of something which resists and impresses us with the conviction of *substance:* but, nevertheless, we cannot demonstrate that we have a positive perception of substance; we perceive its qualities—*impenetrability* or *solidity*, *extension*, *figure*, *colour:* and this, as Dr. Reid expresses himself, from the constitution of our nature, leads us to refer to something which is extended, figured, and coloured. In the same manner, although we have no distinct evidence of the existence of the mind, yet we are conscious of *sensation*, *thought*, and *volition;* and this at least implies the existence of something which feels, and thinks, and wills. Every man feels that his sensations, thoughts, and volitions belong to a part of himself which is distinct from his body; for, if he lose a leg, or an arm, or both, or all his legs and arms, this feeling, thinking, and willing part of his being is as vigorous as ever: he has a clear demonstration, therefore, that it is not a material substance, nor the result of material organization, since it is not liable to be impaired by the loss or mutilation of many of his organs; nor even when his nervous system is deranged. It may, however, be said that we have not so strong an evidence of the existence of mind as of body; but a little reflection will convince us that this is an error, since, to use the language of the elegant Dugald Stewart, "the one is suggested to us by the subjects of our consciousness, and the

other merely by the objects of our perceptions." If this be correct, the establishment of the distinction between mind and matter requires no process of metaphysical reasoning; our notions of both are merely relative: "we know the existence of body, of *matter*, only by such sensible qualities as *extension*, *figure*, and *solidity*; that of mind, by such operations as *sensation*, *thought*, and *volition*: both are known to us only by qualities and attributes; of the essence of either we must confess we are totally ignorant." Having these remarks before us, let us now examine how far the operation of medicines on the body is influenced by this *feeling*, *thinking*, and *willing* part of our being.

The powerful influence of mind over the functions of the body is well known to every observing physician. The facetious author of Tristram Shandy strongly expresses this fact when he compares the body and the soul to a coat and its lining; "if you rumple the one, you rumple the other." This influence is exerted according to the nature of the passions; which may be all arranged into two classes: the *depressing* and the *exciting*. Among the former, we find *Vexation*, *Sorrow*, *Fear*, and *Terror*; among the latter, *Hope*, *Joy*, and *Confidence*. It is necessary to be aware of the influence of both on the system of a patient; not only at the moment when the physician is about to prescribe for him, but in observing the effects of the medicines prescribed. But, besides the passions, many other mental influences,—for example, *Imagination*, *Credulity*, *Superstition*,—exert a similar power.

a.—*Vexation* disturbs the functions of the stomach, altering its natural secretion, the gastric juice; and thus, by impairing the digestive powers, it becomes a very common cause of dyspepsia, or stomach complaint of that description in which the mucous membrane of the organ is in a state of subacute or erythematic inflammation*.

b.—*Sorrow* diminishes the energy of the nervous system, lessens the force of the circulation, impedes the secretions, and finally induces organic diseases. The appetite and sleep become impaired, the blood is imperfectly changed, owing to its passing too slowly through the lungs; flatulence, colic, spasms, display the altered functions of the stomach; whilst that of the liver is evidently affected, as is displayed in the sallow, often truly jaundiced, countenance of the sufferer. Long-continued *Care* and *Anxiety* operate in the same manner as *Sorrow* in causing a nervous erethism, in which every feeling of the body becomes a cause of painful consciousness. The stomach, in this condition

* "Care and suffering are devils, sir—secret, stealthy, undermining devils, who tread down the brightest flowers in Eden, and do more havoc in a month than time does in a year."—*Dickins' Barnaby Rudge*, p. 32.

of the habit, is kept in a state which renders it the seat of constant conscious sensation, and such acute sensibility, that the attention is ever directed to it; which still greatly augments its morbid condition.

c.—*Fear* paralyzes the muscular powers of the body, weakens and even arrests the motions of the heart, so that a congestion of blood occurs in the central vessels, and the surface becomes pale. Indeed, so completely does fear sometimes exert its sedative effects, that Dr. Parry, in his Elements of Pathology and Therapeutics, remarks that he has seen it, in a few seconds, remove all the incipient symptoms of fever. Its effects upon the secretions are well known: it suppresses the catamenia, produces diarrhœa, sweats, and a sudden involuntary flow of urine: it also generally increases the danger and fatality of diseases. By lowering the powers of Nature, it so modifies the influence of remedies, as often to enable the disease to baffle the most judicious practice, and resist the most powerful medicinal agents. I have seen patients, recovering from acute diseases, suddenly thrown back by a sudden alarm regarding their condition: and, in more than one instance, death has followed soon after this feeling took possession of the mind.

d.—*Terror*, which is an augmented degree of *Fear*, acts so powerfully on both the secretions and excretions, that infants, imprudently applied to the breast when the mothers are still under the agitation of some serious alarm, are liable to be seized with convulsions, owing to the change which it effects in the secretion of the milk. I had an opportunity of witnessing, some years ago, the following striking illustration of the influence of mind over body. I was consulted by an officer in the army, a man of great personal bravery and a distinguished soldier, who was suffering under the last stage of *Phthisis*. His love of the military profession, and that delusive hope of recovery which always accompanies this disease, led him to object strongly to the sale of his commission, although it was by such a measure alone that he could hope to leave his wife and daughter, an only child, above the reach of absolute poverty. His wife, who knew his situation, and the necessity for his disposing of his commission, was nevertheless so much swayed by her affection, that she would not join in the persuasion of his friends and myself to take the necessary steps for obtaining the consent of the war office to effect the sale; and, therefore, it was not until he began to feel the truth of his situation that our wishes were acceded to. At length, a petition to the Commander-in-chief was drawn up; and a will, in favour of his wife and child, having been made at the same time, I was requested to be a witness to his signature of both instruments. I saw the deeds executed, and left him seated in bed, apparently more comfortable than he had previously been for weeks; but, before many minutes had elapsed,

I was recalled by the servant; and, on returning, found my patient dead. His wife was standing by the bed-side, erect but motionless. I spoke to her; she heard me not: I took her hand; the muscles were rigid and she felt not: there was no volition: her eyes were open, but they were staring upon vacuity; there were no obvious symptoms of respiration, no rising of the chest, no dilatation of the nostrils: she was warm, but the pulse was not perceptible: in short, she was in that state which is termed *ecstasis;* as inanimate as a statue; and, although living, yet as stiff and as rigid as a corpse. She continued in this condition for forty-eight hours; then recovered her power of volition and of speech; but she was not restored to her usual health for many months; during which her brain was seriously affected. Here, the torpidity of the body was the result of the sudden transition from satisfaction to extreme grief; the mental cause operating upon the nerves nearly in the same manner, but in a more extended degree, as the irritation of a wound when it produces tetanus. Instances are recorded in which even the retrospect of danger has caused such a degree of *terror* as to prove fatal. Among other cases, the following is related by Ludovicus Vires. "A Jew, in France, passed, in the dark, without harm, over a dangerous plank which lay over a brook: the next day, on viewing the perilous situation in which he had been, he fell down dead."

e.—Joy operates as a powerful and exhausting stimulus on the nervous system: thence, when sudden, it will sometimes induce an attack of atonic dyspepsia. Many instances of its fatal effects are recorded. I need scarcely recall to the mind of the classical student the fate of Sophocles, who died on being crowned for composing a successful tragedy in his old age; nor that of Chilon of Lacedemon, who, whilst embracing his son, when declared victor in the Olympic games, died in his arms; nor the stories of the Roman ladies, who died on seeing their sons return from the battles of Trasymenus and Cannæ. A fact nearer home, and more to our purpose, is that related by Dr. Mead, that, in the memorable year of the South Sea bubble, more individuals went mad who acquired sudden fortunes, than those who were ruined by that speculation. Much of this effect of Joy on the nervous system is connected with temperament; the impulse that kills one man, will often scarcely rouse the smile of another.

f.—Confidence, on the same principle, acts as a tonic to the whole animal frame; whence we find "that the result of a medicine," as Dr. John Reid justly remarks, "depends much upon the respect which the patient feels for his physician." Confidence in the power of the medicine is of equal importance with that in the skill of its prescriber; its efficacy, indeed, often depends on this belief of the patient. Upon this basis is founded

the cures sometimes performed by the nostrums of the empiric. Is it assuming too much to refer to the same cause the influence of the infinitesimal doses of the homeopathists. Faith will give a virtue to the most inefficient remedy; a distrust in the abilities of a professional adviser will often defeat the tendency of his most judicious and seasonable prescriptions.

g.—Imagination. The direct influence of the *Imagination* over the corporeal functions is no less obvious than that of the passions. The watering of the mouth when we think on food which is agreeable, is a familiar illustration of this fact. The idea of disgust sometimes causes nausea and even vomiting. This is strikingly illustrated in the following anecdotes. "A respectable farmer in Scotland, when a young man, had sat up for a whole night with some companions, and drank ale and spirits until he became sick, and had most unpleasant sensations. For more than twenty years afterwards, he never came near, nor passed the house, without suffering sensations similar to those which he had experienced on the night of his debauch." I know a gentleman who cannot hear the description of any surgical operation without fainting: yet, he is a man superior to affectation. How far *education* and *refinement* tend to augment this morbid sensibility, I shall not venture an opinion; but, certainly, in the upper ranks of society, while both conduce to form character, the latter, carried to excess, tends to enervate the frame to an extent which not only lays the foundation of diseases, but renders the best efforts to remove them, when they are present, productive of disappointment and utterly fruitless.

The disease termed *Nostalgia*, or Home-sickness, a complaint depending greatly on the influence of Imagination, to which the Swiss and the natives of mountainous countries are peculiarly liable, is a striking instance of the power of moral causes to produce even organic diseases: for, in the dissections of these cases, as we are informed by Avenbruger, adhesions of the pleura, and appearances of inflammation having affected the lungs, are almost always observed.

Very similar effects to those produced by home-sickness, are those resulting from *disappointments* in *love* upon the female frame; which, also, may be referred to the influence of the Imagination in reference to the future. The pulse becomes small and tremulous; the spirits dejected, as indicated by deep sighs; the stomach suffers; the appetite fails; cold sweats and watchfulness follow, which gradually terminate in consumption, sometimes in insanity. This is especially the case when there is a necessity for a concealment of the tender passion: like intense grief, it gradually undermines the constitution; hope flies the mind; the whole bodily powers fail; the menses are suppressed; and the cachectic aspect of the countenance soon points

out that some secret cause preys upon the heart, disturbing all the operations both of the body and the mind*. In such a state, the influence of the most active medicines is scarcely felt upon the habit; the well-grounded expectations of the prescriber are frustrated; and the patient sinks, the victim of the influence of moral causes on the bodily functions.

In regarding these effects of the influence of the mind upon the functions and structure of the body, we cannot be surprised that the same agent should greatly control the operation of medicines. "Your faith has made you whole," is a phrase of Scripture, which has been properly understood as implying a miracle, in circumstances to which it alludes: but the expression is also applicable, as I have already hinted, to daily experience, without resorting for an explanation to supernatural aid. It is this which often renders the same medicine more successful in the hands of the practitioner who has acquired popular celebrity, than in those of other persons more conversant with the nature and the treatment of diseases. "A similar remark," says Dr. Reid, adverting to this subject, "may be made with regard to medicines themselves. A new medicine will often obtain a fortuitous fame, during the continuance of which there is no doubt that it actually produces some of those salutary effects which are ascribed to it. But the fault of these new remedies is, that they will not keep. For as soon as the caprice of the day is gone by, and Fashion has withdrawn her protecting influence, the once-celebrated recipe is divested of its beneficial properties, if it do not become positively deleterious; by which it would appear that its reputation had not been the result of its salutary efficacy, but that its salutary efficacy had been, in a great measure at least, the result of its reputation."

We acknowledge the powerful control of *Imagination* in the ordinary affairs of life; we say that it is the source of the most refined of our pleasures: it supplies the painter and the statuary with all the subjects on which their genius is exercised; it furnishes the poet with the materials which he combines: can we then be surprised that it should influence the body in disease; and, consequently, powerfully modify the action of medicines? It must be remarked, however, that it is only on minds of an inferior stamp, and we find these in every rank of society, that Imagination exerts its powerful influence over the operation of medicines: and it is a subject of curious inquiry, how it happens that, in this matter, Imagination operates more upon those who are less accustomed to exercise it, than

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* "She pin'd in thought,
And, with a green and yellow melancholy,
She sat, like Patience on a monument,
Smiling at grief."—*Shakespeare.*

on the more intellectual, who are in the hourly habit of indulging in and cherishing its visions? To answer this query, we must admit, that the chief mental difference between these two classes of individuals is displayed in the regulation of thought, or the possession of that power which enables us to dismiss or take up certain ideas at pleasure. Now, to the class to which I have alluded as being generally most influenced by imagination, in matters relating to disease and its treatment, although the mind is usually almost wholly absorbed with common-place perceptions and ordinary occupations, yet, when the Imagination is once excited, the objects of it cannot be dismissed as they can be by a well-governed mind; they become, therefore, paramount for a period: the Imagination opens the mind of the patient to believe any thing: he arrives at a state of the most absurd credulity: nothing appears impossible to him; and his recovery from disease, the preservation of his life, even his death, depend altogether on the workings of his Fancy. However well adapted a remedy may be to fulfil the indications for which it is prescribed, if the patient have no confidence in it, all that will result from its use will be disappointment; whereas his faith will render the most inert medicines powerful, and even bestow properties upon some the most opposite to those which they usually exert. Nothing can so satisfactorily demonstrate the influence of mind over body, as the following fact recorded by Sir William Ellis. A patient fancied that "she had been infected by syphilis in some unaccountable mode, and could not rest satisfied until put under what she imagined to be a course of mercurial medicines. After having taken these for a short time, though nothing more than pills made of bread crumbs, the patient, from the expectation that they were to produce salivation, spat such a quantity of saliva as to require a vessel constantly by her side for that purpose. After this had continued for some time, she imagined that the medicine had produced its effect: she discontinued the pills, and the excessive action of the salivary glands ceased*."

It is to the operation of this condition of the mind that we must attribute the few *real* cures recorded in the annals of modern Empiricism; and those well-authenticated instances of people dying at the exact time which they themselves had prognosticated. On the same principles, a physician should always cheer a timorous patient, and raise his confidence both in himself and in the medicine which he prescribes; for even, in such a state of mind, the very look of a physician, whose opinion the patient has been accustomed to regard with reverence, if it bespeak danger, almost pronounces the sentence; and too often it unhappily executes itself.

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* Ellis on Insanity, 8vo. 1838, p. 414.

"We are not ourselves,
When nature, being opprest, commands the mind
To suffer with the body*."

h.—Credulity. In medicine, Credulity is not a modern folly: thirteen hundred years have elapsed since Ætius described and ridiculed the nostrums of his time, and the extravagant sums paid for them. The Collyrium of Danaus was sold at Constantinople for one hundred and twenty numismata, equal to nine pounds sterling, according to the present value of coin. Dr. Fauceby, physician to Henry VI, pretended to be an adept in the occult sciences, and obtained a commission from that king to discover an universal medicine, called *the Elixir of life*, for the cure of all diseases, wounds, and fractures, and for prolonging life, the health and strength of the body, and the vigor of the mind, to the greatest possible extent of time. Dr. Henry, the historian, who quotes this passage from Rymer's Fœdera, adds, with great simplicity,—"We have no account of the success of this undertaking." Credulity, however, has sometimes cured diseases†.

Credulity differs from *Superstition:* the former may be defined a deficient state of the faculty of judgment, or a neglect of exercising it in particular instances; the latter an improper application of the faculty of judgment, a conviction that the event which is to be believed is impossible, as far as human means can effect it, but that it is nevertheless accomplished through supernatural agency. Thus, when we read that the Payes of the Indian tribes in Brazil, who are physicians, conjurors, and exorcists, cure diseases by sucking the part affected, and spitting it into a pit, as if to give back to the earth the evil principle which they assert is the cause of disease and has been sucked out of the sick person, we have an example of credulity and also of superstition in those who believe them. It is *credulity* to believe that a disease can be thus extracted, as if it were a material substance: it is *superstition* to believe that disease is an evil principle, and can be conquered only through the medium of the priesthood. Superstition is more the companion of Ignorance than Credulity, although there are some men who are naturally incapable of weighing the preponderance of contrary proofs and testimonies: but, very often, Credulity arises from mere indolence of the reasoning faculty; and a man takes what is told to him upon trust, because it is too much trouble to ascertain the probability of the proposition‡. In either case, when Credulity is wrought upon by knavery, and "unluckily

* Shakspeare.

† This was most strikingly exemplified at the time when Metallic Tractors occupied the attention and imposed upon the credulity of the public. Dr. Haygarth removed Rheumatic pains by Tractors made of wood, ivory, and even gingerbread.

‡ Two days ago (June 27th, 1832) I heard a barrister, one of the most distinguished ornaments of the British bar, declare in open court his confidence in the remedial power of Metallic Tractors. The following conclusion of a quack advertisement,

too"—to borrow the words of Edmund Burke—" the credulity of dupes is as inexhaustible as the invention of knaves." On this account, it becomes a greater obstacle to the advancement of medicine than even Superstition. But, as its influence on the operation of medicines is undoubted, it becomes a question, how far an honest physician is authorized to call it into his aid in the treatment of disease? If the idea were correct that a physician degrades his profession by yielding to the tide of opinion, this question could only be answered in the negative: but a physician must be guided by his own judgment as to the propriety of such a step. He may see it necessary to respect a wholesome prejudice; and may honestly act upon his patient's credulity in order to secure his confidence in the powers of certain medicines; or, independent of medicines, he may take such an advantage to secure the relief of his patient from the pressure of disease: for, as has been remarked by an able writer, whose words I have quoted more than once, " It is of little consequence whether a man be healed through the medium of his fancy or his stomach."

i. Superstition.—The influence of *Superstition* over the operation of medicines is much more limited than that of Credulity; but it operates as a powerful obstacle to the advancement of medicine in those countries where it still exists. At an early period in the history of society, Superstition supplied many articles of the Materia Medica; but as education advanced, these fell into disuse. The influence of Superstition arose from the characters of Priest and Physician being combined in the same person. This was the case with the Jews, as we learn from the Mosaical accounts of their early history. The priests of Esculapius were also the first physicians of the Greeks. The Druids were those of the Northern nations: and, in the history of our own country, we read that, after the Anglo-Saxons had embraced the Christian religion, the clergy were the only medical practitioners. The first medical book translated into the Saxon language was the work of Apuleius on the virtues of herbs; and on this the whole of the practice of medicine was founded until the tenth century, when the monks took up both the teaching and the practice of the healing art, and drew their information from the writings of Galen, Rhazes, Avicenna, and other Arabians, which were translated into Latin and deposited in the monasteries. In the eleventh century, the clergy applied themselves particularly to the study of Materia Medica. Richard Fitz-Nigel, who died Bishop of London, A.D. 1198, had been Apothecary to Henry the Second: Roger Bacon, who flourished in the thirteenth century, practised physic, although a monk: in the same century, Nicolas de Farne-

placarded in Dinan in Brittany, was firmly believed by the simple people of that town. " J'ai le pouvoir executer le médecine aussi bien avec mes pieds que le premier medecin du monde avec ses mains."—*Trollope's Travels in Brittany.*

ham, physician to Henry the Third, was made Bishop of Durham: and many other doctors of medicine were, at various times, elevated to ecclesiastical dignities. It was even thought essential that physicians should remain in a state of celibacy; and it was not until the fifteenth century that they were permitted to marry in countries professing the Roman Catholic religion. In periods like these, Superstition held her sway over the credulity of the multitude, in matters relating to the cure of their diseases. It was easier for a crafty priesthood to work upon the weakness of the human mind than to investigate the nature of diseases and their remedies: thence, we find that charms, exorcisms, and other impositions were practised by the clerical physicians of that period. Little confidence was placed in medicines, even at a later period; for Burton, in his anatomy of Melancholy, informs us "that there was of old no use of physicke amongst us, and but little at this day, except it be for a few nice idle citizens, surfetting courtiers, and staufed gentlemen lubbers. The country people use kitchen physicke."

If we go back to the period of Scripture history, we find that the Jews had great faith in phylacteries—a species of amulets, which are still held in esteem in India and other Eastern countries. They consisted of portions of Scripture written upon vellum of a shape and size adapted to the part of the body on which they were to be worn. Thus, a phylactery for the head, preserved in the Duke of Sussex's library, consists of four slips of vellum, with verses from Scripture written on each. These are separately rolled up, and placed in a small leathern bag, upon which is written the word *schin*. It is tied to the head by means of thongs of leather, so as to permit the bag to rest on the forehead. These phylacteries are called tephillin, shel-rash, tiffila of the head. Those for the arm are called sheljad: they are written upon a strip of vellum, which is rolled up spirally to a point, and enclosed in a case made of the skin of any clean beast. They are bound upon the arm, in a situation as near to the heart as possible, by a thong which must go seven times round the arm in a spiral manner and terminate by being wound three times round the middle finger. Coral, worn round the neck, was supposed to possess the power of driving away evil spirits*.

As Christianity advanced, the clerical physicians seemed anxious to render the dogmas of the existing religion subservient to medicine; and, consequently, relics were introduced into the Materia Medica. When Louis XI was suffering from his last illness, the holy phial was sent to him from Actium,

* It is melancholy to think that a relic of this superstition is still countenanced by the higher ranks in this country: beads formed of the root of Bryony, Bryonia *dioica*, are strung together, and sold under the name of anodyne necklaces for facilitating the protrusion of the teeth in the gums of an infant!

and St. Peter's vest from Rome; but, at this time, both confidence and superstitious faith were of no avail. We read, also, that bread, dipped in oil at the shrine of St. Anthony, at Rome, was believed to prevent Hydrophobia in those bitten by a rabid animal; that a ring, taken from the body of St. Remigius, and dipped in water, produced a drink very efficacious in fevers; and the following cure for Epilepsy in children is recommended by John of Gaddesden, Walter Gilbert, and others, who flourished in the thirteenth century. "When the patient and his parents have fasted three days, let them conduct him to the church. If he be of a proper age, and in his right senses, let him confess. Then let him hear mass on Friday, during the fast of *quatuor temporum*, and also on Saturday. On Sunday, let a good and religious priest read, over the head of the patient, in the church, the gospel which is read in September, in the time of vintage, after the feast of the holy cross. After this, let the priest write the same gospel devoutly, and let the patient wear it about his neck, and he shall be cured. The gospel is—'This kind goeth not out but by prayer and fasting.'"

It would be a waste of time to enumerate many of these absurdities: I shall notice one more only, because it descended almost to our own times; I refer to the royal touch for the cure of Scrophula. This superstition took its rise in the reign of Edward the Confessor; and nothing can demonstrate, more clearly, the powerful influence of the mind over the body than the effects which followed when it was employed. In 1349, Bishop Bradwardine wrote respecting it, in these strong terms: "Whoever thou art, O Christian! who deniest miracles, come and see with thine own eyes, come into England in the presence of the king, and bring with thee any Christian afflicted with the King's Evil; and though it be very ugly, deep, and inveterate, he will cure him in the name of Jesus Christ, by prayer, benediction, the sign of the cross, and the imposition of hands*." The Kings of France exercised the same healing touch as the English monarchs. When Wolsey was on his embassy to the French king in 1526, at Amiens, that king, on entering the Bishop's Palace, where he intended to dine with the Cardinal, had his steps arrested by "about two hundred persons, diseased with the King's Evil, upon their knees. "And the king, or ever he went to dinner, provised every one of them with rubbing and blessing them, with his bare hands (being bare headed all the while): after whom followed his almoner, *distributing money unto the persons diseased*. And that done, he said certain prayers over them, and then washed his hands†." In England, money was also distributed on similar occasions.

* Bradwardine de Causa Dei, l. x, ch. x, p. 39.
† Cavendish's Life of Wolsey, edited by Singers, 2nd edition, p. 168.

Queen Elizabeth exercised the touch for the King's Evil; and Lancham, in his "Account of the Entertainment at Kenilworth Castle," avers that he saw Queen Elizabeth cure nine persons "without other medicines than by touching and prayer." Even the great Bacon believed in the power of charming away warts. The doctrine of *sympathetie* indications and cures, indeed, would fill volumes; and although many of them are to be referred to *idiosyncracy*, yet not a few are altogether the work of *Credulity*.

But the influence of Credulity and Superstition could not continue; and, although Credulity still sways, in some degree, the multitude, and quackery flourishes, yet education has already opened the eyes of the ignorant and expelled the mummeries of *Superstition*. It must, however, be admitted, that even the most absurd means of cure adopted by Superstition were sometimes beneficial—a circumstance which we must attribute to the confidence they inspired, acting as a powerful tonic on the corporeal frame.

Upon the whole, there can be no doubt that Imagination, Credulity, and Superstition, influence powerfully the operation of medicinal agents; and that their effects ought to be familiar to the physician. In knowing the extent of their influence, he is enabled to determine the real value of a medicine; how much is due to the workings of Credulity, or Superstition; and how much to the impression which the previous character of the medicine has made upon the mind; and thence inspiring the patient with confidence in its curative powers.

7. INFLUENCE WHICH THE PERIOD OF A DISEASE EXERTS OVER THE ACTION OF MEDICINES.

It is easy to conceive that many circumstances connected with the progress of disease (the changes, for example, in the nervous irritability, in the force of the circulation of the blood, and in the temperature of the body) must tend to render the administration of a medicine which acts beneficially at one period of the attack, less beneficial at another. A few examples will illustrate the truth of this position. If a drastic purgative be given soon after an ague has been checked by tonics, it is probable that the disease will return—a remark which was noticed by Sydenham and De Haen, both high authorities in all practical matters. Thus, also, at the commencement of *dysentery*, whilst inflammation of the mucous membrane exists in the large intestines, it would be extremely hazardous to administer stimulants; but, when the inflammatory symptoms have abated, when the debility, which is the result of that state, alone threatens the life of the patient, they may not only be perfectly admissible, but

requisite. In some diseased conditions of the habit, a purgative may prove fatal, if administered at an improper time, independent of that state of great corporeal debility which would prevent any sensible practitioner from prescribing a medicine the operation of which would only add to the already too greatly exhausted state of the body. Again, if Foxglove be administered, the influence of the period of disease in controlling its operation is very evident. In dropsy, for example, if it be given early, whilst the pulse is hard, quick, and incompressible, it produces no beneficial effects, the action of the capillaries is not increased, nor is the secretion of urine augmented; but, if the excitement be first reduced, whether by bleeding or any other means, the remedy then fulfils the intention of its administration: it stimulates the capillaries, and enables the absorbents to relieve the serous sac of the superabundant fluid which has been deposited in it, and throws it upon the kidneys. Lastly, the salutary influence of the affusion of cold water on the surface of the body, when the morbid heat in fever is intense, is well known; it lowers the temperature, lessens the frequency of the pulse, and induces perspiration and sleep; but when it is employed during the cold stage, the pulse falls till it becomes feeble and fluttering; the surface and the extremities shrink, and life may be the forfeit of ill-timing the application of this valuable remedial agent.

The nature of the symptoms of disease often greatly modifies the operation of medicines: large doses of opium may be swallowed with impunity, during violent pain or spasm, one half of which, in the ordinary condition of the habit of the patient, would prove highly injurious, if not fatal. In diseases connected with great excitement, also, opium is injurious in the commencement, although, in combination with other medicines which diminish its stimulant properties, no remedy is so efficacious after bleeding, purging, or any treatment which can bring down the hardness and lessen the frequency of the pulse. It is injurious in the hectic stage of pulmonary consumption, from its tendency to promote sweatings, although, in the early stages of consumption, it is highly beneficial.

In the same way, Cinchona Bark, the salts of its active principle, Quina, although the best remedies for intermittent fevers, when administered at the proper period of the disease, yet, if exhibited during the hot stage of the paroxysm, they increase all the bad symptoms. In some local affections, also, symptoms closely resembling those of ague present themselves: as, for example, in stricture of the urethra, a fit of ague is induced by a debauch of wine,—by the introduction of a bougie armed with caustic into the urethra,—and by many other sources of irritation; yet, whilst Bark or Disulphate Quina in such cases effects little benefit, a saline purgative removes every symptom of

ague. Squill has been successfully employed as an expectorant and a diuretic; but its operation is much influenced by the period of the disease at which it is prescribed. If given, for instance, during the continuance of inflammatory action, it invariably proves injurious, and, therefore, either bleeding, purging, or some other means of diminishing arterial excitement, are essential, in order to secure the beneficial action of squills.

In this manner the influence which any substance possesses in allaying disease, depends in some degree on the period of the disease, and the circumstances under which it is administered, as well as the condition of the body at the time, and the activity of the medicine itself. In truth, no substance, the mildest in its effects, can be given in improper doses or at improper times without proving hurtful; and, in the same point of view, the most nutritious and wholesome articles of diet may be ranked, almost, among the class of poisons. Even in prescribing external remedies, it is of importance to attend to the period of the disease.

8. CIRCUMSTANCES IN WHICH MEDICINES MAY PROVE INJURIOUS.

Many salutary processes occur in the progress of disease, which should not be checked by an improper administration of medicines. Thus, violent shiverings and tremors of the body, unaccompanied with coldness, and not followed by preternatural heat, occasionally relieve acute gouty pains; but, when these are interfered with, metastasis or a translation of diseased action occurs, and the inflammation, instead of remaining in the toe or instep, may attack the head or the stomach. In the administration of local remedies, also, much caution is requisite; and every day's experience teaches us why many local diseases cannot be removed, or even checked, by local remedies, without the hazard of converting topical into general disease, or causing what may be termed a constitutional effort in some other part more essential to life than that which the attempt was made to relieve. In the administration of some *internal* medicines, also, the result may be a check to the salutary action of some local disease on the system, and thus, for a temporary and delusive suspension of present suffering, the most serious evil may follow. The shivering which often attends the passing of a gall-stone is supposed to operate like exercise, and to aid the propulsion of the extraneous body. Even convulsions sometimes may be regarded as salutary processes. Dr. Parry mentions the case of a young lady who was long afflicted with headache, vertigo, and vomiting, which at length ended in total blindness, so as to induce a belief that she laboured under hydrocephalus internus; all the symptoms were, in a few hours, removed by a sudden fit

of convulsions*. I have mentioned these instances to shew that the knowledge of the powers of a remedy does not constitute all which the physician ought to possess previous to prescribing it, even supposing he has taken into account all the circumstances which have been described as likely to modify its effects: he must, also, be convinced that no danger will result from its salutary influence in one part of the system, producing a translation of diseased action to another previously in a healthy state.

SECTION IV.

CIRCUMSTANCES WHICH MODIFY THE MEDICINAL PROPERTIES OF PLANTS.

It is supposed by Dr. Prichard "that the vegetable creation was originally divided into a number of different provinces. Each country, perhaps each chain of mountains, had its peculiar tribes of plants, which at first existed not elsewhere;" and that from these, as from a centre, each kind spread in various directions over the surface of the globe. There is much ingenuity in this supposition; but, as the same plants are, also, found in very distant countries, in the same latitudes, it is as probable that they were originally scattered over the globe, in bands within certain latitudes, adapted by temperature to their nature, and by soil to their nourishment. Some plants, indeed, have an entirely isolated and local existence; being found naturally on some particular spot and never elsewhere. In whatever manner they were originally disposed, or have been since naturally diffused, man, endeavouring to bend Nature to his control, has naturalised plants to climates very opposite to those in which they were originally found, and improved them by cultivation; thence the chief agents in modifying the medicinal properties of plants, are *climate, cultivation, age,* and *locality.*

a.—Climate. Plants, like animals, feel the influence of climate; and, consequently, medicines of a vegetable origin have their active powers more or less changed, if removed from the spots where Nature had planted them, to be cultivated in foreign soils. This is, indeed, an almost insurmountable obstacle to the naturalization of medicinal plants of latitudes greatly different from that of their nativity. In general, the virtues of the plants are diminished, if not totally destroyed, by the transportation.

The effect of climate upon the medicinal properties of plants is strikingly illustrated in the history of the Meadow Saffron,

* Elements of Pathology and Therapeutics.

Colchicum *Autumnale*. In England and many other countries, the Colchicum always contains an acrid, alkaline, bitter principle, *Colchicia*, of great importance as a remedy, and a virulent poison when overdosed. At some seasons of the year, the bulb of the Colchicum, in this country, is more active than at other seasons; but, during the whole year, it contains a sufficient portion of its medicinal principle to render it a very hurtful substance if eaten as food: yet in other parts of the globe it may be eaten with impunity at some seasons. Kraterhvill, a German author, in his work "de Colchico," relates instances in which entire bulbs were eaten without any bad effect being produced on the habit. Krapf, another German writer, says that he has eaten the bulb with impunity in autumn, and that it is then eaten in Carniola and Istria: yet autumn is the period of the year when the bulb is most active in this country. The celebrated Haller, also, avers that it is both tasteless and inert in autumn. Now, to what are we to ascribe those peculiarities in the Colchicum of the countries in which these writers lived, except to climate? For the same reason, Senna transported from Upper Egypt and grown in the South of France, varies both in the external characters of the leaf and in its purgative properties: the leaves are more obtuse, less bitter, and less nauseous when chewed, and much less purgative than the Egyptian Senna. The tree named Myrospermum *frutescens*, when it grows in New Grenada, yields *Balsam of Tolu;* but when it grows in Peru, it yields a very different Balsamic substance; which, from the place of its production, has been named *Balsam of Peru.* The Cinchona trees lose much of the value of their bark when they grow in close and warm valleys; such, for example, as are found to the north of Huallaga; whilst those in Santa Fè and New Granada are totally inert. On the contrary, the Cinchonas which grow in the forests of Huanuco, on the coldest and most elevated spots, are the richest in the alkaloids; and consequently the most valued. I may also mention that the genus *Mentha*, and many other plants which yield an essential oil, afford it of a much less penetrating odour in the South of Europe than in England: and, it is a curious fact, that almost all strong smelling plants lose their odours in a sandy soil.

From these facts, it is obvious that the nature of the climate in which medicinal plants are indigenous should be known. Indeed, so very important is it that medicines should always be as nearly as possible the same, that a medicine coming from any other part of the world than that from which it was originally obtained, ought not to be trusted in the cure of diseases, until a set of comparative experiments have determined its affinity in every respect to the original drug.

b. Cultivation has a close resemblance to climate in its effect upon the medicinal properties of plants. Few plants which are medicinal, admit of cultivation, although edible vegetables are

greatly improved by it. In the cultivation of edible plants, the object is to increase the proportion of feculent and farinaceous matter in roots, in tubers, and in bulbs; and, consequently, if any acrid or active principle which they may contain be not proportionably augmented, the same weight of the root, tuber, or bulb, must necessarily be less active, in the direct ratio of the diminution of the quantity of the medicinal principle in proportion to the farinaceous part. Another object of the horticulturist is to convert the simple flowers of nature into the more showy inhabitants of the parterre, by doubling them, as it is termed; that is, converting the generative organs into petals; or, in compound flowers, the disk or tubular florets into what are termed ligulate. In this manner the Chamomile, Anthemis *nobilis*, is often doubled; but as the medicinal virtue resides chiefly in the disc florets, the conversion of the natural flower into the double variety greatly deteriorates the strength of the remedy.

c.—Age. Many medicinal plants do not acquire their active qualities until they have attained what may be termed adult age: even poisonous plants may be eaten with impunity when they are young: some, again, have their active principles suddenly developed at a fixed period of their existence: the Lettuce, for example, when merely in leaf, possesses scarcely any of the narcotic principle which constitutes the Lactucarium of the Pharmacopœias, although it is abundantly secreted during the flowering season. In the Poppy, the narcotic principle is scarcely apparent until the petals fall and the germen enlarges. The Henbane, Hyoscyamus *niger*, and several biennial plants, possess no activity in the first year of their growth. The soil also, its dryness or its moisture, the degree of exposure of the plant to heat, light, and air, all contribute to modify its medicinal qualities; thence it happens that plants collected in one year may display great activity, whilst in the next they may appear almost inert. A plant which grows naturally in a dry or an absorbent soil, is generally less active when it is found growing in a humid or a marshy situation: another, which is the ordinary inhabitant of an exposed spot, and requires the invigorating influence of the stimulus of much light, heat and air, languishes and loses its medicinal virtues when it rises accidentally in the forest; whilst others, again, only acquire them in the shade. It is, indeed, these circumstances, in a great measure, which distinguish climates, and which augment the remedial properties of vegetable bodies that owe their activity to volatile oil, resins, and the balsams. The knowledge of these facts is of great importance to the collectors of medicinal plants; who should be able to determine the period in the life of a plant, the nature of the soil, the degree of exposure, and the season of the year most favourable to the development of its active properties.

PART II.

SECTION I.

NATURAL CLASSIFICATION OF MEDICINAL AGENTS.

THE substances employed as medicines are found, in common with the other objects of Nature, every where surrounding us. They are prescribed either in their *natural* condition, that is, as they are found ready formed on the surface of the earth or beneath it; or as they are *artificially* prepared, that is, changed from their natural condition, either by the abstraction of some of their parts, or by the addition of new parts. The natural substances consist of both simple and compound bodies, derived from the organic and inorganic kingdoms of Nature; the artificial are the productions of the Pharmaceutical Art: thence, the study of the nature of medicinal agents implies some acquaintance with Natural History and Chemical Science.

The medicinal agents which are the products of organization are of animal and of vegetable origin: the inorganic substances are minerals.

ANIMAL SUBSTANCES.

The animal products are few. As objects of Natural History, I prefer arranging the animals which yield them according to the Classification of Cuvier, which is now generally adopted: and as, in describing them hereafter, I shall have occasion to make frequent reference to that system, I think it necessary to present here a brief sketch of it.

This system arranges the whole of the known animals under four principal groups.

1. VERTEBRATED ANIMALS.
2. MOLLUSCOUS ANIMALS.
3. ARTICULATED ANIMALS.
4. RADIATED ANIMALS, or ZOOPHYTES.

1. The VERTEBRATED ANIMALS, *Animalia Vertebrata*, which forms the first great Division of the Animal Kingdom, are those

in which the body and its members are supported by a skeleton or osseous frame-work, consisting of numerous pieces articulated together, moveable upon one another, and affording points for the origin and insertion of the muscles, with which this frame-work is more or less completely covered. The brain, and the spinal marrow, the principal trunks of the nervous system, are contained in a cavity, composed of various bones forming a cranium and a hollow vertebral column. The Vertebrata have all red blood; a muscular heart; a more or less voluminous liver; two horizontal jaws; distinct organs of seeing, hearing, smelling, tasting, and touching: and the sexes are in two separate individuals. This Division contains four Classes—1, *Mammalia;* 2, *Aves;* 3, *Reptilia;* 4, *Pisces.*

The first Class, MAMMALIA, named from the animals being furnished with mammæ, which secrete milk for the nutriment of their young, is the only class of this division that contains animals yielding Medicinal substances. It comprehends nine Orders; namely—1, *Bimana;* 2, *Quadramana;* 3, *Carnivora;* 4, *Marsupialia;* 5, *Rodentia;* 6, *Insectivora;* 7, *Pachydermata;* 8, *Ruminantia;* 9, *Cetacea.* The first four Orders contain no animals yielding Medicinal agents.

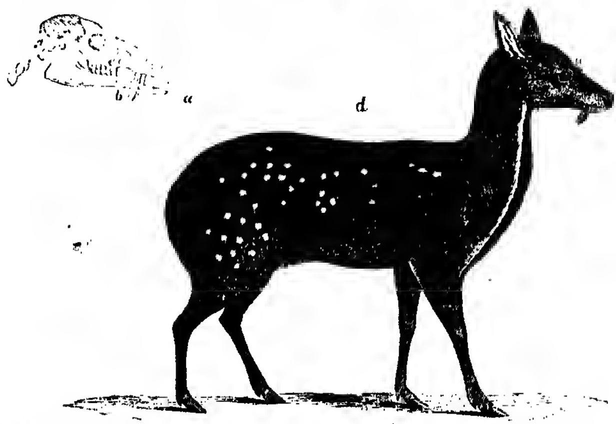
The fifth Order, *Rodentia,* is well exemplified by the Beaver, Castor *fiber (see cut, d).* It is characterized by each jaw

containing two strong, sharp, curved, cutting teeth, in front *(a a),* with an empty space *(b)* between them and the grinders on each side *(c).* The posterior extremities of the animals are, in general, longer than the anterior, a circumstance which gives them an awkward gait. The intestinal canal is long, the stomach simple, and the cœcum very large. The Beaver, which is a good specimen of the Order, is an amphibious animal, and supplies the medicine named *Castor*—a secretion, deposited in two sacs situated between the pubic arch and the cloaca of the male.

The seventh Order, *Pachydermata,* contains animals with two or more toes on each foot, furnished at their extremities with nails closely approximating to hoofs *(a),* which cannot be used for grasping. In general, the canine teeth *(b)* are curved

tusks, projecting out of the mouth. Some of the genera have a proboscis, others a truncated snout *(c)*. They have no clavicles. In the second division of this Order we find the Hog, Sus *scrofa (see cut)*, from whose flanks *Lard* is obtained.

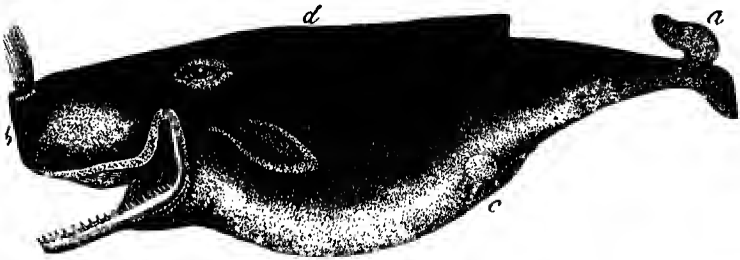
In the eighth Order, *Ruminantia*, of the same class, the chief characteristic, as its name implies, is the rumination of the animals—a faculty connected with the disposition of their stomachs, which are four in number. The first stomach is a mere recipient of the food, whence it passes into the second, where, moistened by the secretions of the first and the second stomachs, it is formed into small globular pellets, in which form it is returned into the mouth by a kind of eructation, and remasticated before it descends into the third stomach, where it is divided into thin flakes. Lastly, it passes into the fourth, which is the real digesting organ. The animals in this Order have no incisors in the upper jaw *(a)*; some have canine teeth *(b)*, which project from the mouth: they are furnished with two hoofs, so placed in relation to each other that they resemble one cleft hoof; whence the name *cloven-footed*. They are all phytivorous animals. In the division of the Order containing animals *without horns*, we find the Musk



Deer, Moschus *moschiferus (see cut, d)*, the animal which yields the Musk. In the second division of the same order, in which are

arranged animals *with horns,* and in the first subdivision containing animals who *shed their horns,* we find the Stag, Cervus *elaphus,* from the horns of which a nutritive gelatine is extracted; in the second subdivision, containing those whose *horns* are *permanent,* we find the Goat, Capra *hircus;* the sheep, Ovis *aries;* and the Bull and the Cow, Bos *taurus;* all of great value in yielding demulcents and dietetic substances.

The ninth Order, *Cetacea,* contains animals which resemble fishes. They have no posterior extremities, only a transverse tail fin *(a):* their head, which is large *(b),* is united to the trunk of the body by a very short, indistinct neck: the anterior extremities resemble fins: the mammæ are placed either on the breast, or near the anus *(c).* The Cetacea breathe by lungs, which obliges them often to rise to the surface of the water.

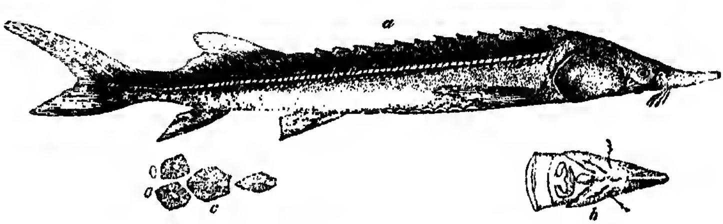


They are warm-blooded animals. In this Order we find the Spermaceti Whale, Physeter *Macrocephalus (see cut, d*—a female).

The second Class of the Vertebrata, Aves, comprehends six Orders; but one only, the *Gallinaceæ,* furnishes a medicinal agent; namely, the Domestic Fowl, Phasianus *gallus,* every part of the egg of which is either medicinally or pharmaceutically employed.

The third Class, Reptilia, contains the Lizard, Lacerta *scincus* (Scincus *officinalis),* and the Viper, Coluber *Berus,* both of which were formerly employed as medicines; but they are now properly rejected from the list of the Materia Medica, in Great Britain.

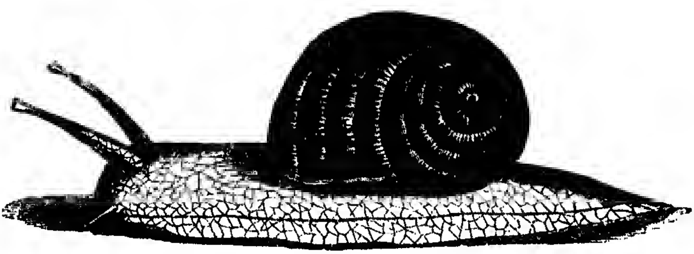
Among the Pisces, the fourth Class, the Sturgeon, Accipenser *huso (see cut, a),* is still employed for yielding Gelatine, in



the form of Isinglass. In the Sturgeon the mouth *(b)* is placed beneath the head: it is tubular, and devoid of teeth. The body is armed with indurated plates and spines *(c)*. The swimming bladder forms the Isinglass.

The Cod, Gadus *Callarias* and G. *Morhua*, the liver of which yields an oil containing Iodine in combination, also belongs to this class.

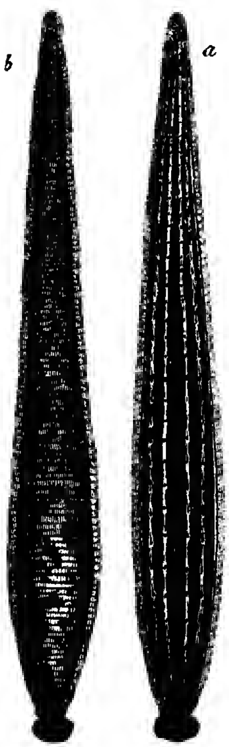
2. The MOLLUSCOUS ANIMALS, *Animalia mollusca*, have no articulated skeleton; and the nervous system consists of medullary masses, situated in different points in the body; but they have a double circulation. The muscles are attached to different points of the skin; and they move by contractions. There are six Classes in this Division; namely—1, *Cephalopoda*; 2, *Pteropoda*; 3, *Gasteropoda*; 4, *Acephala*; 5, *Brachiopoda*; 6, *Cirrhopoda*. The Molluscous Animals formerly supplied three medicinal agents; namely—the Cuttle-fish, Sepia *officinalis*, the Vine-snail, Helix *pomatia*, and the Oyster, Ostrea *edulis*. The Cuttle-fish *(see cut, a)*, one of the *Cephalopoda*, furnished the Os Sepiæ, an oblong, lamellated bone, deposited in the mantle of the animal, and yielding a very pure Carbonate of Lime, with a trace of Phosphate of Lime, and also of Magnesia. The Vine-snail *(see cut)*, one of the *Gasteropoda*, yields a demulcent aliment, at one time



prescribed in Phthisis. The Oyster, one of the *Acephala*, was supposed to be the best food in Phthisis, and the shell, which consists chiefly of carbonate of lime, with traces of Phosphate of lime, and of alumina, was administered as an absorbent. But all of the molluscous animals are now rejected from the British Pharmacopœias.

3. The ARTICULATED ANIMALS, *Animalia articulata*, the third great Division in the system of Cuvier, are characterized by the successive joints or articulations which constitute their bodies, and which are, for the most part, horny or stony, although, in a few instances, they are soft. Their nervous system consists of two cords, united by ganglia, at certain distances, whence the nerves are given off. The Articulated Animals breathe either by gills, or by lateral stigmata: and, in a few instances, by cellular cavities analogous to lungs. The organs of circulation vary considerably: in some instances a heart exists; in others there is no heart: the organs of the senses, with the exception of that of sight, are little developed.

This division consists of four Classes:—1, *Annelida;* 2, *Crustacea;* 3, *Arachnoida;* 4, *Insecta.* The first, second, and fourth, contain animals which are either employed as medicinal agents, or yield medicinal substances.

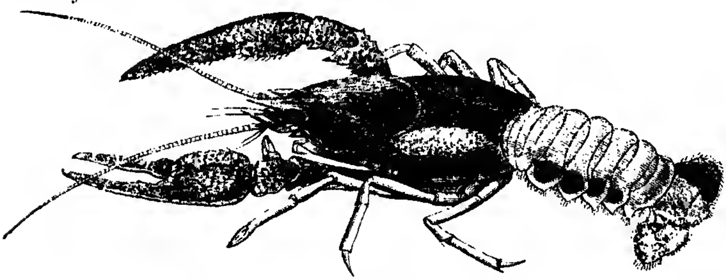


The first Class of this Division, ANNELIDA, is characterized by the body of the animal being soft, and formed of either a great many rings, or segments of rings. Although the circulation is carried on both by arteries and veins, yet, there is no distinct heart. The animals have generally from two to three jaws; but in some instances the mouth consists of the open extremity of a simple tube. They breathe in general by gills, but, in some instances, by pores; and they live chiefly in water. They are all hermaphrodites, and copulate reciprocally.

The third Order of the Annelida, the *Ebranchiata*, contains animals devoid of visible, exterior, respiratory organs; and here Cuvier has placed the Leech, Hirudo *officinalis* (*a*—back; *b*—belly). The propriety of this situation for the Leech is questionable, as I shall endeavour hereafter to demonstrate, in treating of its remedial uses.

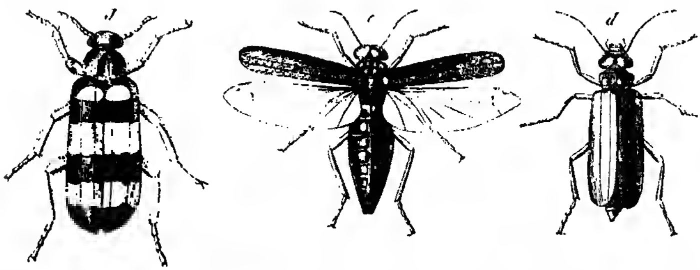
The second Class of the Articulata, CRUSTACEA, is distinguished by the articulations being hard, crustaceous, or stony. The animals have a double circulation; they breathe by gills, variously situated. The nervous system consists of numerous ganglia, disposed in pairs. There are in general four antennæ or feelers; and the eyes are sometimes sessile, sometimes elevated upon an articulated pedicel.

In the first Order, *Decopoda*, we find the Cray Fish, Astacus *fluviatilis (see cut)*, which yields concretions formed in the stomach just before the shell is cast. They consist chiefly of Carbonate of Lime, and were formerly employed as antacids; but they are now seldom used.



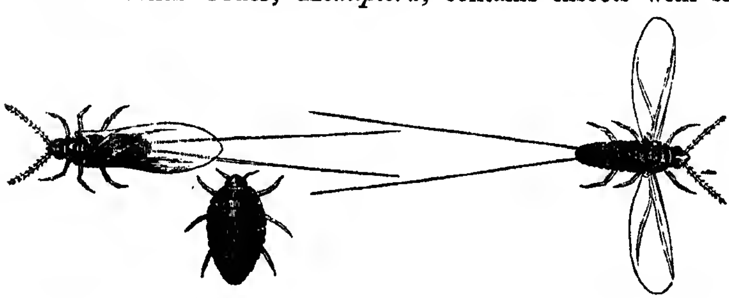
In the fourth Class, Insecta, of this Division, we find three medicinal Orders. The characters of the Class are so various, that it is unnecessary to describe them.

The fifth Order of the Class, *Coleoptera*, is characterized by the insect having six feet and four wings, the two uppermost of which are elytra or sheaths, horny, and always parallel to one another: they have mandibules and jaws. The insects of this Order undergo a complete metamorphoses. We find here the Blistering Beetle, Cantharis *officinalis (d e)*, and the Mylabris



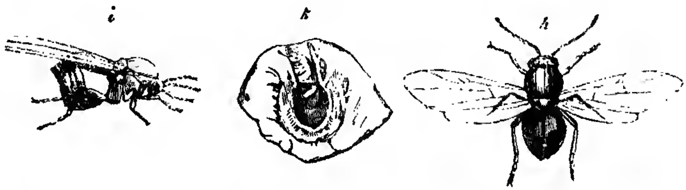
variabilis (j); all of which yield the blistering principle, *Cantharidin*. The perfect insects are soft when they change from the chrysalis; but they harden after exposure to the air.

The seventh Order, *Hemiptera*, contains insects with six

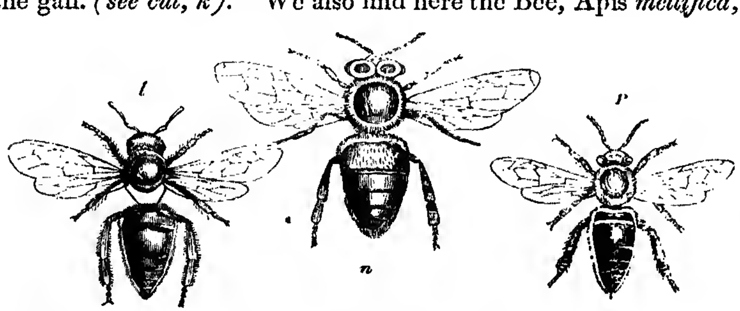


legs and four wings, of which the upper are larger and stronger than the lower, and horny and firm at the root, but soft and membranous at the outer extremity. The head is depressed upon the chest; and although some of the genera have jaws, yet, the greater number are furnished with a proboscis. Here we find the Cochineal insect, Coccus *Cacti (see cut,* p. 73*)*; the wingless insect is the female; the winged in two positions is the male.

In the ninth Order, *Hymenoptera,* the insects have six feet and four membranous wings, which cross one another and lie flat on the body; a mouth composed of mandibules, and jaws, with two lips. The upper wings are the largest; both have few nerves. The antennæ are variable, but they are the same in both sexes. The females have the abdomen terminated by a piercer, which, with the oviduct, consists of three pieces. Their larvæ resemble worms. The perfect insects live on flowers. This Order contains the Gall Insect, Cynips or Diplolepsis *gallæ tinctoriæ*



(see cut; h, the male; *i,* the female). The egg is laid in the footstalk of the leaf of the Dyers oak, which is perforated by the piercer of the insect, and a drop of acrid fluid is deposited with the egg. The insect is hatched, and undergoes its transformation from the larva to the perfect insect before it eats its way out of the gall. *(see cut, k).* We also find here the Bee, Apis *mellifica,*



the manufacturer of both the wax and the honey employed in medicine. There are three varieties of the honey Bee, in every community of these insects; *(see cut; n,* the male; *l,* the female; and *p,* the neuter or working Bee).

4. Radiated Animals or Zoophytes, *Radiata, Zoophyta,* contain five Classes. The organs of motion surround a centre; there is no distinct nervous system; no particular organs of the senses; and scarcely any traces of circulation.

In the fourth Class of this Division, *Polypi*, which closely resemble plants, each body consisting of an aggregate mass of animals, and reproducing by germs, we find only one medicinal agent, the Sponge, Spongia *officinalis*.

The Coral, Isis *nobilis*, is now rejected from the list of the Materia Medica.

SECTION II.

VEGETABLE SUBSTANCES.

Although the Linnean or Artificial System be that which was long employed for classing medicinal plants, as objects of Botany, yet, the Natural System holds out so many advantages to Medical Science, that there can be one opinion only of its superiority in a practical point of view, for the arrangement of vegetable therapeutical agents. It informs the medical inquirer not only of the botanical affinities of the plants, but it also supplies him with a knowledge of their properties and qualities. This acquaintance with the properties of even one plant of any order, enables him to form some idea of the remedial value of all the other plants of the same order, and, if needful, to substitute, upon fixed principles, any one of them for that which is more usually employed.

The great Divisions of this System are *two*.

I. Vascular Plants, Vasculares; plants having spiral vessels, both in the stems and leaves; cuticular stomata*; distinct flowers; and sexual organs†.

II. Cellular Plants, Cellulares; plants chiefly composed of cellular tissue; and generally devoid of cuticular stomata; wholly devoid of spiral vessels, and of visible sexual organs.

The Division, Vasculares, contains, with a few exceptions, all the plants comprehended in the Materia Medica of the British Colleges. It is subdivided into two Classes:

1. Dicotyledonous Plants, or Exogenæ; plants with a more or less conical stem, consisting of both cellular and vascular tissue, and composed of distinct pith, wood, and bark; reticulated leaves, articulated with the stem, which increases by new layers of wood and bark annually deposited. The propagation is effected by stamens and pistils; and the fruit encloses an embryo with two or more opposite cotyledons or

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* Stomata are organized pores, perhaps for breathing, like the spiracula of insects.
† Sexual organs comprehend the anthers and stigma.

seed lobes. The plants of this Class are either *Polypetalous*,—having distinct petals; or they are *Incomplete*,—having no petals, and in some instances no calyx; or they are *monopetalous*.

2. MONOCOTYLEDONOUS PLANTS, or ENDOGENÆ; are plants with no distinction of pith, wood, and bark, in the stem; with leaves displaying parallel veins; and fruit having an embryo with one cotyledon only; or, if there be two cotyledons, they are not opposite, but alternate. The increase of the stem is by central additions. The seeds are, in the greater part of this Class, *Angiospermous**.

Seven-eighths of the medicinal plants in the British Pharmacopœias belong to the first of these Classes; as will appear in the following arrangement of them under the Orders. Those plants not contained in the British Pharmacopœias are marked with an asterisk†.

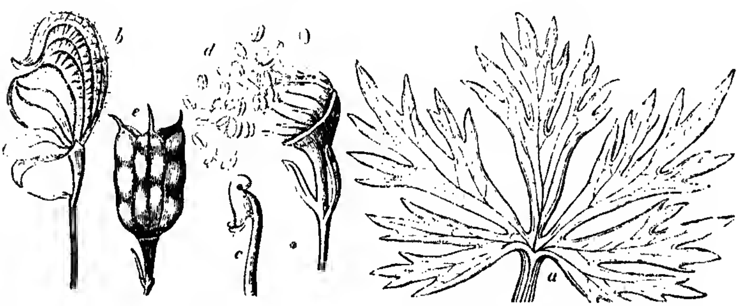
CLASS I.

EXOGENS, or DYCOTYLEDONS.

SUB-CLASS I. POLYPETALÆ.

Plants having both calyx and corolla: the latter composed of distinct petals.

ORD. 1. RANUNCULACEÆ.—Shrubs and Herbaceous plants,



with divided, opposite, or alternate leaves *(a)* having generally a dilated half-sheathing petiole: the *calyx* formed of 3-6 deciduous sepals‡, sometimes petaloid *(b)*; the *petals* 2-15, distinct in one or more rows; in some instances irregular *(c)*: *stamens* hypogynous§,

* Plants having seeds contained in a capsular seed vessel.
† The Orders only which contain British Pharmaceutical plants are mentioned.
‡ Parts of the calyx.
§ Hypogynous—rising from a lower surface than the female parts.

indefinite in number *(d)*: *anthers* bursting by longitudinal slits: *pistilla* numerous on a torus: *fruit* distinct, usually consisting of simple, associated carpella* *(e)*, containing albuminous seeds, an arillus†: and with a minute embryo.

Geo. position: Europe, India.

Yielding a narcotic principle:

Aconitum *paniculatum.*	* Aconitum *Anthora.*
——— *Napellus.*	* ——— *ferox.*

a tonic principle:

* Hydrastis *Canadensis.*	* Anemone *cernua.*
* Coptis *trifolia.*	* Zanthorhiza *apiifolia.*

* Actæa *spiccata.*

a purgative principle:

Helleborus *niger.*	Helleborus *officinalis.*
* ——— *Orientalis.*	* ——— *fœtidus.*

an acrid principle:

* Clematis *dioica.*	* Anemone *pulsatilla.*
* ——— *erecta.*	* ——— *pratensis.*
* ——— *vitalba.*	Ranunculus *flammula.*
* Knowltonia *vesicatoria.*	* ——— *bulbosus.*
* Nigella *sativa.*	——— *acris.*
* Delphinium *consolida.*	* ——— *sceleratus.*

Delphinium *staphisagria.*

Ord. 2. Papaveraceæ.—Herbaceous plants with a milky

juice, and more or less divided, alternate leaves *(a)*: *flowers* polypetalous, single, on long *peduncles*: *sepals* 2 *(b)*, deciduous: *petals* 4, or some multiple of 4: *stamens* hypogynous: *ovarium* one-celled *(c)*, with a sessile stigma *(d)*; and narrow, partial placentæ *(e)*: *seeds* numerous.

Geo. position: Europe, Persia, China, Japan.

Yielding a narcotic principle—Bimeconate of Morphia:

Papaver *somniferum.*

a narcotico-acrid principle:

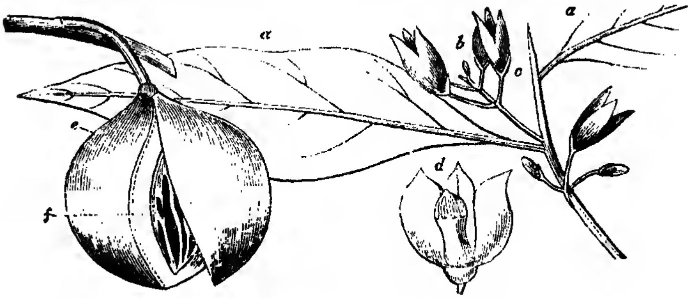
* Argemone *Mexicana.*	* Sanguinaria *Canadensis.*

* Carpellum—one of the seed vessels of a compound fruit.

† Arillus—an expansion of the umbilical cord surrounding the seed.

an acrid principle: *a colouring matter*:
* Chelidonium *majus*. Papaver *Rhœas*.

ORD. 6. MYRISTICACEÆ. Trees with alternate leaves with-

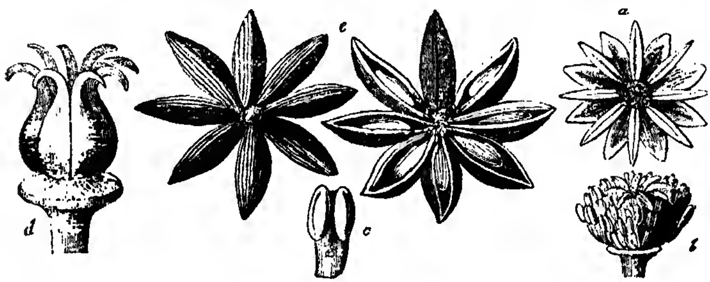


out stipulæ, entire, stalked, and coriaceous *(a)*: the *flowers* in racemes* or panicles† *(b)*, each flower having a short cucullate bracte‡ *(c)*. The flowers are diœcious and apetalous, with a three-lobed coriaceous *calyx (d)*, and columnar *stamens*: the *fruit* is baccate, dehiscent, and bivalved *(e)*: the *seed* enveloped in a many-parted arillus *(f)*.

Geo. position: Tropics of India and America.

Yielding an aromatic volatile oil:
Myristica *Moschata*, or *officinalis (see cut)*.

ORD. 8. WINTERACEÆ.—Trees or shrubs with alternate,



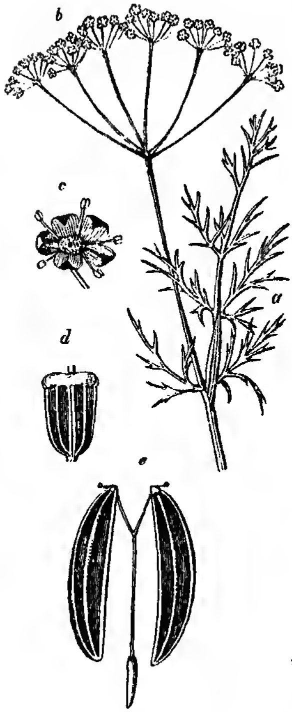
coriaceous, dotted leaves, with convolute deciduous stipules. The *flowers* are polypetalous *(a)*, with hypogynous, short *stamens (b)*, indefinite in number, and furnished with oblong, adnate *anthers*, bursting by longitudinal slits *(c)*; *ovaries* connate at the base *(d)*, one-celled. The *fruit* consists of numerous, distinct, simple carpella *(e)*.

Geo. position: Southern temperate zone.

Yielding a stimulant and aromatic oleo-resin:
Drymis *Winteri*.
* Illicium *Floridanum*. * Illicium *anisatum*.

* Racemes—several individual flowers on a long axis.
† Panicle—where subordinate stalks of a common stalk are subdivided.
‡ Bracte—a floral leaf.

ORD. 11. UMBELLIFERÆ.—Herbaceous plants, with fistular striated stems, and divided or simple leaves *(a)* sheathing at the base; *flowers* in umbels* *(b)*; the *calyx* entire or five-toothed; *petals* 5, alternate with perigynous *stamens*, and incurved in æstivation *(c)*; *ovarium* didymous† *(d)*, with two *styles*, consisting of two *carpels* separable from a common axis, and traversed with vertical ridges *(e)*; each has, in some instances, near the base, *vittæ*, or linnear receptacles of oil. The *embryo* is minute, in fleshy albumen.



Geographical position: The northern parts of the northern hemisphere.

Yielding an aromatic volatile oil: excitant—diuretic.

* Apium *petroselinum.*
Carum *Carui.*
Pimpinella *Anisum.*
Fœniculum *vulgare.*
* ———— *dulce.*
* ———— *Panmorium.*
Daucus *Carota.*
* Daucus *gummifer.*
Coriandrum *sativum.*
* Anethum *graveolens.*
* Anethum *Sowa.*
* Meum *Athamanticum.*
* Athamanta *Cretensis.*
* Peucedanum *officinale.*
* Archangelica *officinalis.*

an acrid gum-resin: excitant, antispasmodic.

Ferula *Persica.*
——— *Assafœtida.*
* ——— *ferulago.*
* ——— *hooshe.*
Galbanum *officinale.*
Opoponax *Chironium.*
* Imperitoria *Ostruthium.*
* Cuminum *Cyminum.*
Dorema *Ammoniacum.*
* Angelica *nemorosa.*
* Laserpitium *glabrum.*

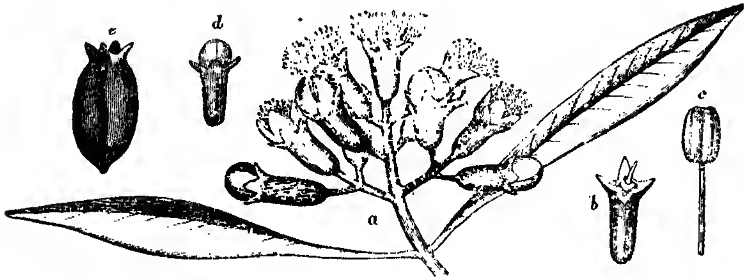
a narcotic principle:

* Cicuta *maculata.*
* Cicuta *virosa.*
* Anthriscus *sylvestris.*
* Œnanthe *crocata.*
* Œnanthe *Phellandrium.*
* Cachrys *odontalgica.*
Conium *maculatum.*

* Umbel—that form of inflorescence in which the subordinate stalks, rising on the summit of a common flower stalk, extend in rays.

† Two joined together.

ORD. 28. MYRTACEÆ.—Trees or shrubs with opposite,



entire leaves *(a)*, covered with semitransparent dots: *flowers* polypetalous, with a superior 4-5 cleft *calyx (b)*: indefinite perigynous *stamens*, with ovate *anthers (c)* bursting lengthways: *ovarium* inferior *(d)*, with several cells: *fruit* dry or fleshy *(e)*.

Geo. position: South America, East Indies.

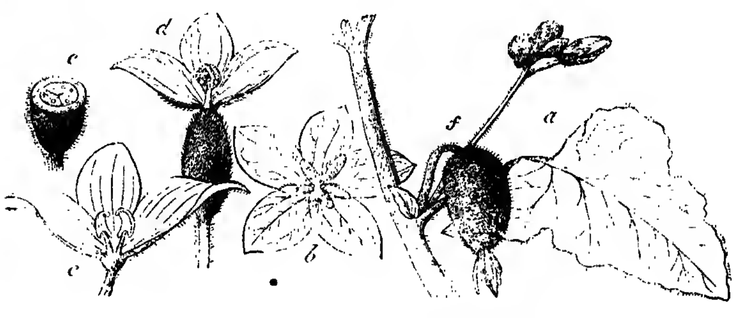
Yielding an aromatic volatile oil:

Melaleuca *minor* (M. Cajuputi). *Calyptranthus *aromatica*.
Caryophyllus *aromaticus (see cut)*. *Eugenia *Pimenta*.
*Eugenia *acris*.

an astringent principle:

Punica *Granatum*. *Eucalyptus *robusta*.
*Eucalyptus *resinifera*. *———— *mannifera*.

ORD. 34. CUCURBITACEÆ.—Climbing herbs, with palmated,



succulent, scabrous leaves *(a)*: *flowers* unisexual *(d* female, *c* male), monopetalous, with a five-toothed *calyx (b)*; and five-parted, regular, cellular *corolla (b)*: *stamens* cohering in three parcels *(c)*: *anthers* long, sinuous: *ovarium* inferior, with three parietal placentæ: *fruit* fleshy *(e f)*: *seeds* flat: *testa* coriaceous: *embryo* exalbuminous.

Geo. position: Tropical climates: a few in the North of Europe, North America, and the Cape of Good Hope.

Yielding a purgative gum-resin :

Cucumis *Colocynthis.* * Cucumis *Hardwickii.*
* Fêuillia *trilobata.* * Bryonia *alba.*
* Bryonia *dioica.*

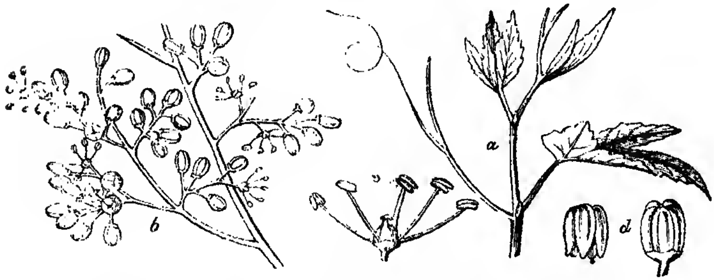
Elatin—powerfully cathartic :

Momordica *Elaterium.* * Momordica *balsamina.*
* Melothria *pendula.*

a bitter principle—tonic :

* Trichosanthes *amara.* * Tricosanthes *cordata.*

ORD. 17. VITACEÆ.—Climbing shrubs with tumid, separable



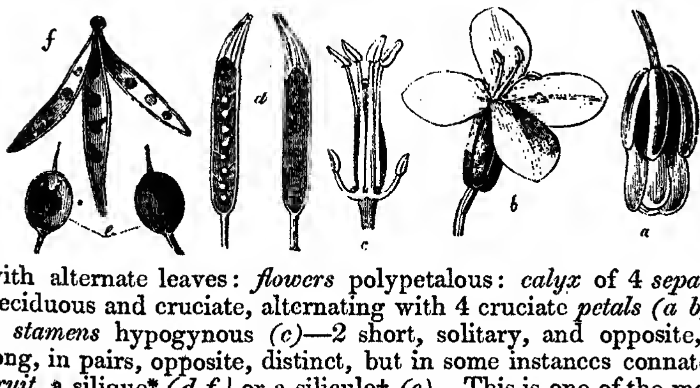
joints and stipulate leaves *(a)*: *flowers* polypetalous, small, green, symmetrical, on ramose peduncles *(b)*: *calyx* sometimes separating like a calyptra *(d)*: *stamens* hypogenous, definite in number, with distinct filaments, and ovate versatile anthers *(c)*: *ovarium* superior, two-celled: *fruit* baccate, pulpy: *seeds* albuminous, with an erect embryo.

Geo. position: Warm and temperate zones of both hemispheres.

Yielding a saccharine matter and acids :

Vitis *vinifera.*

ORD. 41. BRASSICACEÆ or CRUCIFERÆ.—Herbaceous plants



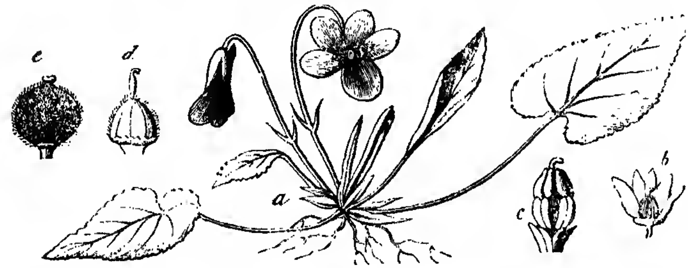
with alternate leaves: *flowers* polypetalous: *calyx* of 4 *sepals*, deciduous and cruciate, alternating with 4 cruciate *petals (a b)*: 6 *stamens* hypogynous *(c)*—2 short, solitary, and opposite, 4 long, in pairs, opposite, distinct, but in some instances connate: *fruit*, a silique* *(d f)* or a silicule† *(e)*. This is one of the most natural of the orders.

* Silique—a long, two-valved fruit with seed on both sutures.
† Silicule—a small silique nearly as broad as it is long.

Geo. position : Temperate zones, tropics, and north frigid zone.
Yielding a volatile and pungent principle : excitant, diuretic.

Cardamine *pratensis.* — Sinapis *alba.*
Cochlearia *officinalis.* — ——— *nigra.*
Cochlearia *Armoracea.* — * ——— *Chinensis.*
* Eruca *sativa.* — * Raphanus *sativus.*

ORD. 40. VIOLACEÆ.—Herbs with simple stipulate *leaves*

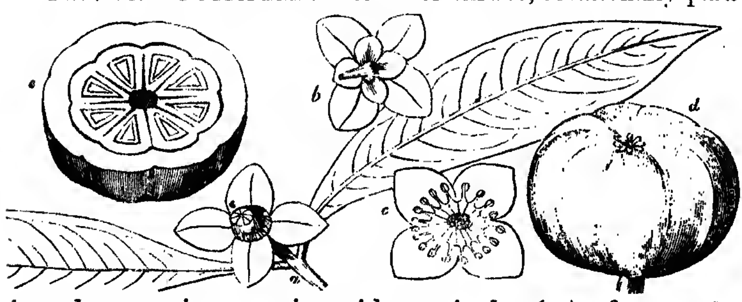


(*a*): *flowers* polypetalous: *calyx* (*b*) five distinct sepals: *petals* same number, hypogynous: *stamens* dilated, alternate with the *petals*, hydogynous, definite, with cohering, bilocular *anthers* (*c*) bursting inwards: *ovarium* (*d*) one-celled, many-seeded, with narrow, parietal placentæ: *style* (*d*) hooked: *seeds* with a straight *embryo*, erect in the *axis* of fleshy albumen: *capsule* globular (*e*).

Geo. position : Europe, America, Siberia.
Yielding a stimulant-emetic principle—purgative :

Viola *odorata.* — * Viola *tricolor.*
* Ionidium *Ipecacuanha.* — * Ionidium *Poaya.*
* Ionidium *Microphyllum.*

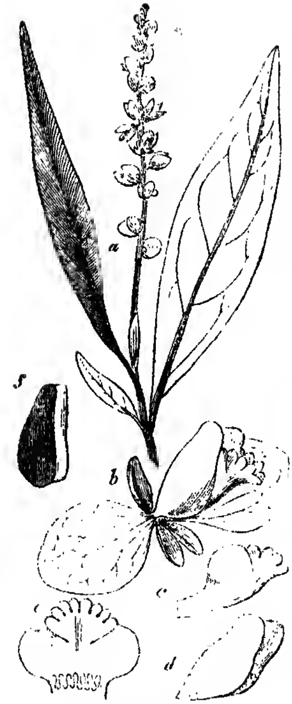
ORD. 54. GUTTIFERÆ.—Trees or shrubs, occasionally para-



sites: *leaves* entire, opposite, without stipules (*a*): *flowers* polypetalous, with a persistent, imbricate, membranous *calyx* (*b*): *stamens* hypogenous (*c*), indefinite in number: adnate *anthers* (*c*): *carpella* concrete: an *ovarium* of several cells (*d*): *ovules* attached to the central placentæ (*e*).

Geo. position : South America, Madagascar.
Yielding a gum-resin—cathartic.

Hebradendron *Gambogioides.* — * Stalagmitis *ovalifolia.*
* ——————— *pictorium.* — Canella *alba.*



Ord. 62. Polygalaceæ.—Shrubs or herbaceous plants with exstipulate leaves *(a)*: *flowers* polypetalous, unsymmetrical *(b)*; *calyx (b)* irregular, imbricated: *petals* three *(c d)*, one being anterior and larger than the rest: *keel (c)* sometimes entire and crested, sometimes lobed and not crested: *stamens* definite, hypogynous in one parcel, usually in a tube *(c)*: *ovarium* superior, two-celled, with a placental *axis*: *fruit* dehiscent, with pendulous seeds: albumen abundant *(f)*.

Geo. position: Asia and America.

Yielding a bitter acrid principle—tonic:

Polygala *Senega.*
* ——— *uliginosa*
* ——— *rubella.*
* Monnina *polystachya.*
* Soulamea *amara.*
— *an astringent matter:*
Krameria *triandra.*
—— *an emetic principle:*
* Polygala *Poaya.*

Ord. 65. Linaceæ.—Herbaceous plants with entire, exstipulate, usually alternate leaves *(a)*: *flowers* symmetrical, polypetalous, consisting of a regular imbricate *calyx (b)*, and unguiculate *petals*: definite, hypogynous *stamens (b)*: an entire *ovarium* of as many cells as sepals, with placentæ in the *axis*, pendulous *ovules*, distinct *styles*, and capitate *stigmas* equal to the number of the cells *(c)*: *fruit (d)* with valves equal to the cells: *seeds* compressed and inverted: exalbuminous, flat *cotyledons*.

Geo. position: Europe and North America.

Yielding Mucilage and fixed oil:

Linum *ussitatissimum.*
—— *a cathartic principle:*
Linum *catharticum.*
* ——— *Selaginoides.*

ORD. 71. * MALVACEÆ.—Herbaceous plants, trees, or shrubs,

with alternate, more or less divided, stipulate *leaves (a)*, covered with stellate pubescence. The *flowers (b)* are polypetalous, with a 5-cleft persistent *calyx (c d)*, with hypogenous, monodelphous *stamens*, and one-celled anthers bursting transversely: *ovarium* formed of *carpella* round a placental axis, distinct or concrete *(c)*: *fruit* capsular or baccate, containing one seed each, circularly arranged round the axis *(e)*.

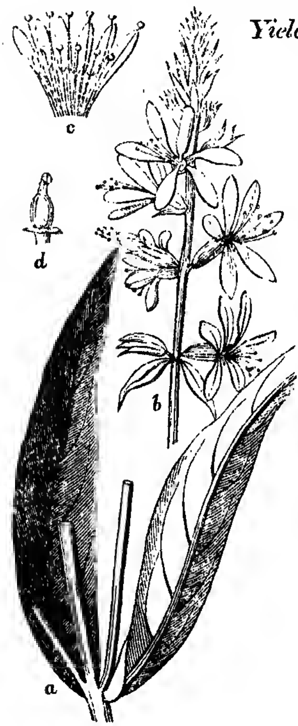
Geo. position: Temperate zone and tropics.

Abounding in mucilage—demulcent:

Althæa *officinalis*. Malva *Sylvestris*.
* Abutilon *Indicum*. * Abelmoschus *esculentus*.
* Urena *lobata*.

Yielding an acrid principle—excitant:

* Abelmoschus *moschatus*.



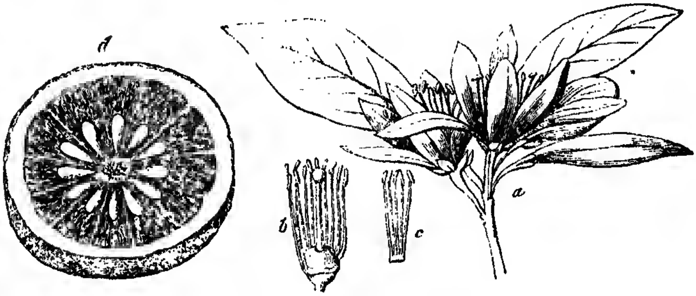
ORD. 75. LYTHRACEÆ.—Herbs rarely with shruby, exstipulate leaves *(a)*: branches frequently quadrangular: flowers regular *(b)*, arranged usually in a spike or a raceme: *calyx* monosepalous: petals variable in number *(c)*, deciduous, inserted between the lobes of the calyx, sometimes absent: *stamens* equal in number to the petals *(c)*, inserted into the tube below the petals: *ovary* superior *(d)*; style filiform, 2 to 4-celled: *fruit*, a membranous capsule, enveloped by the calyx: *seeds* numerous, adhering to a central placenta, without albumen.

Geo. position: Europe, Asia, America.

Yielding an excitant principle—astringent and acrid:

Lythrum *salicaria*.
* Ammannia *vesicatoria*.
* Heimia *salicifolia*.

ORD. 79. AURANTIACEÆ.—Trees or shrubs with alternate,



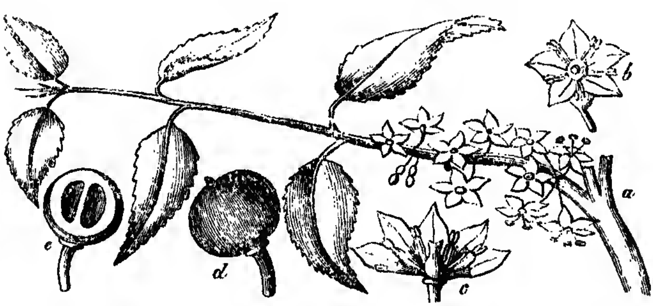
often compound leaves dotted, the petiole sometimes winged *(a)*: *flowers* symmetrical, polypetalous, with an urceolate *calyx*, and *petals* inserted on the outside of a hypogynous disk: *stamens* hypogynous *(b)*, definite, filaments free, or combined *(c)*: *style* single: *ovarium* entire *(b)*, many-celled: *fruit* pulpy *(d)*, rind studded with receptacles of volatile oil: *seeds* attached to the *axis*, with a *raphe** and *chalaza*† distinctly marked, often containing two *embryos*.

Geo. position: East Indies, extending over the rest of the tropics.

Yielding an aromatic oil and acids:

Citrus *Aurantium*. * Citrus *Bigaradia*.
—— *Limonum*. —— *Limetta*
* Bergera *Konigii*. * Feronia *elephantum*.
* Ægle *Marmelos*.

ORD. 81. RHAMNACEÆ.—Trees or shrubs with simple alter-



nate leaves with minute stipules: *flowers* auxillary *(a)* or termi-

* Raphe—the surface by which the two parts of a double fruit touch each other.

† Chalaza—coloured part in the interior membrane of the seed, where the umbilical cord passes into the seed.

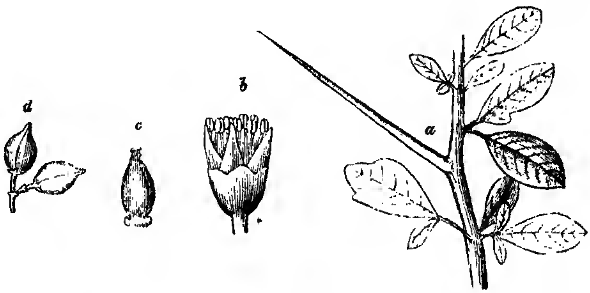
nal, polypetalous: cuculate* *petals* (*b*); valvate *calyx;* perigynous *stamens,* definite in number (*c*): *ovarium* superior, with several cells surrounded by a fleshy disk; *fruit* fleshy, sometimes, and capsular (*d e*); *seeds* erect, albuminous.

Geo. position: General over the globe, except in the Arctic zone.

Yielding a purgative principle:

Rhamnus *catharticus.*	* Zyzyphus *vulgaris.*
* ——— *infectorius.*	* Ceanothus *Americanus.*

ORD. 85. BURSERACEÆ.—Trees or shrubs with irregular,



pinnated, alternate leaves, without pellucid dots (*a*): *flowers* regular, polypetalous: *calyx* persistent: *petals* 3 to 5 on a disk, arising from the calyx (*b*): *stamens* 2 to 4 times as many as the petals, perigynous (*b*): *ovarium* sessile, superior (*c*), 2-celled: *fruit* drupaceous (*d*), with exalbuminous seeds: *cotyledons* wrinkled: *radicle* straight.

Geo. position: Within the tropics.

Yielding Gum-resin and volatile oil:

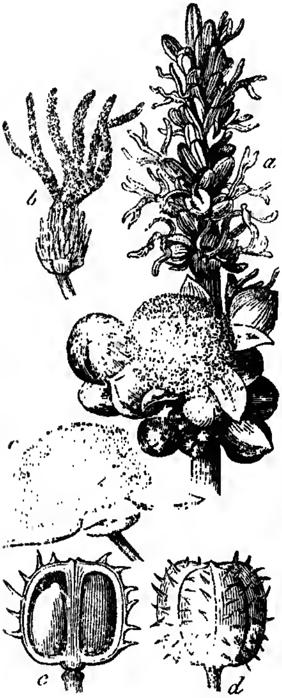
Boswellia *serrata.*	* Icica *heptaphylla*
Protium *Gileadense.*	—— *Icicariba.*
——— *Kataf.*	* —— *Tacamahaea.*
* ——— *Kafal.*	* Canarium *commune.*
* Icica *Aracouchini.*	* Elaphrium *tomentosum.*

* Commiphora *Madagascarensis.*

ORD. 86. EUPHORBIACEÆ.—Trees, shrubs, and herbaceous plants, with opposite, alternate, simple leaves, usually stipulated: *flowers* monœcious (*a*), or diœcious, apetalous, or terminal: *calyx* lobed, often wanting: *stamens* definite or indefinite (*c*): *ovarium* (*b*) superior, three-celled, with definite, suspended, *ovules*: *fruit* three dehiscent cells, separating with elasticity (*d*): *seed* suspended (*e*), with an arillus: *embryo* surrounded with oily albumen.

* Cuculate—surface of the petal deeply depressed.

Geo. position: Equinoctial America and Africa, Cape of Good Hope, a few in Europe and North America.



Yielding an acrid principle:

Euphorbia *officinarum.*
——— *Canariensis.*
* ——— *Antiquorum.*
* ——— *Ligularia.*
* ——— *Lathyris.*

an emetic principle:

* Pedilanthus *tithymaloides*
* Euphorbia *Gerardiana.*
* ——— *Ipecacuanha.*
* ——— *Cerollata.*
* Hura *crepitans.*

acrid oil—purgative, diaphoretic:

* Buxus *sempervirens.*
Croton *Tiglium.*
* ——— *Polyandrum.*
* Anda *Gomesii.*
Ricinus *communis.*
* Iatropha *Cureas.*

an aromatic principle—tonic, excitant:

Croton *Cascarilla.*
——— *Eleuteria.*
* ——— *Draco.*
* ——— *Pseudo-China.*

Yielding nutritive fecula:

Ianipha *Manihot.*

acrid oil—diuretic:

* Phyllanthus *urinaria.*

ORD 99. SIMARUBACEÆ.—Trees or shrubs with alternate

exstipulate leaves *(a)* without dots: *flowers* either bi- or unisexual *(c d)*, polypetalous, symmetrical, with a 4-5 divided *calyx (c)*, and *petals* equal in number to these divisions *(c)*: *stamens* double the number of the petals, rising from a scale *(e)*, hypogynous *(e)*: *ovarium* entire, cellular, 4 or 5 lobed

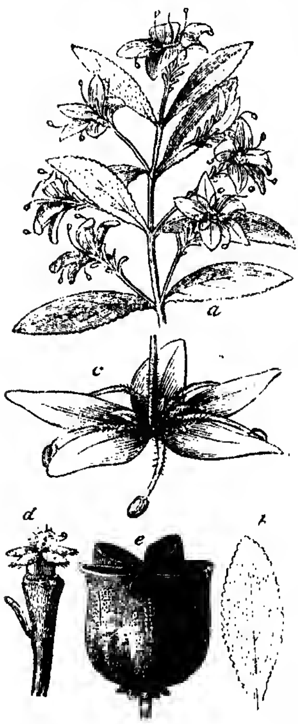
upon a stalk *(d)*; *ovules* solitary, pendulous: *fruit* indehiscent drupes, arranged round a common receptacle *(f)*: *seeds* pendulous, with an exalbuminous embryo.

Geo. position: Tropical America, Africa, India.

Yielding a bitter-tonic principle:

* Quassia *amara.*	Picræna *excelsa.*
——— *simaruba.*	* Nima *quassioides.*

ORD. 100. RUTACEÆ.—Herbaceous plants, shrubs, and trees, with alternate, or opposite, simple, exstipulate, dotted leaves *(a b)*: *flowers* symmetrical *(a c)*, sometimes irregular, in a centrifugal inflorescence: *caylx* *(c)* 4-5 cleft, imbricate: *petals* rarely absent *(e)*, alternate with the divisions of the calyx: *style* single, sometimes divided near the base *(d)*: definite hypogynous *stamens* *(c)*: *ovarium* entire, 5-celled: *carpella* concrete: *fruit* *(e)* capsular, the *endocarp* not separable from the *sarcocarp*.



Geo. position: Temperate zones, equinoctial America.

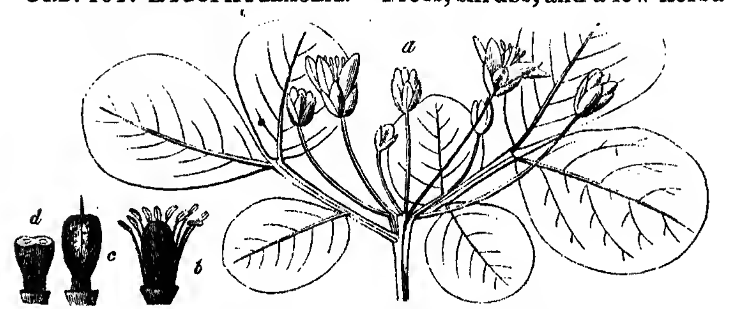
Yielding a bitter, with volatile oil:

Ruta *graveolens.*
Barosma *crenulata.*
——— *crenata.*
* ——— *serratifolia.*
* Ticorea *febrifuga.*
* Evodia *febrifuga.*

Cusparina, in conjunction with volatile oil.

Galipea *officinalis.*
——— *Cusparia.*
* ——— *Malambo?*

ORD. 101. ZYGOPHYLLACEÆ.—Trees, shrubs, and a few herba-



ceous plants with opposite, stipulate leaves without dots, often

articulated at the joints: *flowers* (*a*) polypetalous, symmetrical: *calyx* imbricated: *stamens* (*b*) definite, arising from hypogynous scales, dilated at the base: *ovarium* entire, with several cells: *stigma* (*c*) simple; *fruit* capsular, *carpella* (*d*) concrete: *ovules* pendulous.

Geo. position: America.

Yielding Guiaicum—sudorific:

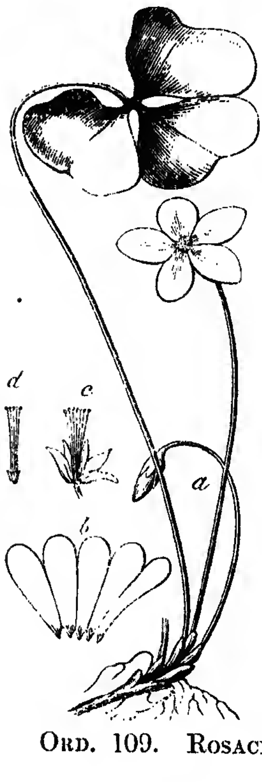
Guiaicum *officinale*. * Porlieria *hygrometra*.

ORD. 105. OXALIDACEÆ.—Herbaceous plants with perennial, scaly-jointed roots and compound alternate leaves (*a*): *flowers* (*a*) polypetalous, symmetrical: *petals* (*b*) equal, five unguiculate, with an imbricated *calyx* consisting of five sepals, distinct or united at the base: *stamens* definite (*e*), distinct, hypogynous, slightly monodelphous: *ovarium* of several cells, with placentæ in the axis: *styles* 5 with pencilled or capitate stigmas (*d*): angled, oblong, or cylindrical *seeds* indefinite, exalbuminous, with a straight *embryo*.

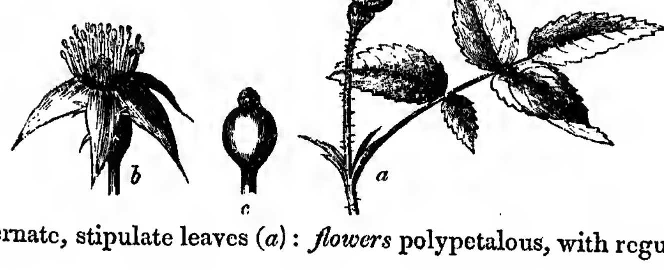
Geo. position: Tropics and temperate zones.

Yielding an acid:

Oxalis *acetosella*.



ORD. 109. ROSACEÆ.—Herbaceous plants and shrubs with



alternate, stipulate leaves (*a*): *flowers* polypetalous, with regular,

perigynous *stamens* (*b*): lateral *styles:* superior, simple *ovaria* (*b c*): exalbuminous, definite *seeds.*

Geo. position: Temperate zone.

Yielding an astringent principle—Tannic acid:

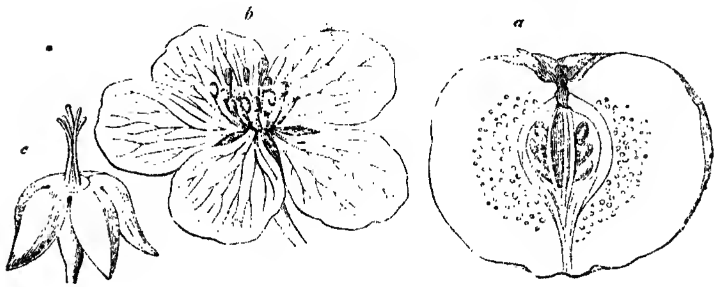
Geum *Urbanum.*	Potentilla *Tormentilla.*
* —— *rivale.*	Rosa *centifolia.*
* Spiræa *filipendula.*	—— *canina.*
* —— *Ulmaria.*	—— *Gallica.*

* Rubus *villosus.*

an acrid principle—emetic:

* Gillenia *trifoliata.*

Sub-ord.— Pomeæ. —Trees or shrubs with alternate, stipu-



late leaves: *flowers* polypetalous, with perigynous *stamens* (*b*), indefinite in number, adhering to the throat of the calyx (*c*): *fruit,* a one or five-celled pome (*a*)*.

Geo. position: Europe, Asia, North America, India.

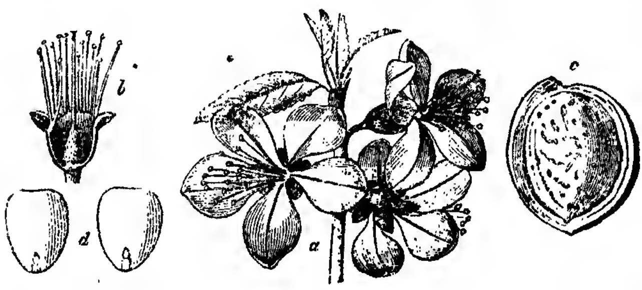
Yielding mucilage:

Cydonia *vulgaris.*

a sedative principle:

* Pyrus *Aucuparia.*

Sub-ord. —Amygdalaæ. — Trees with simple, alternate,



stipulate leaves, glandular at the base: *flowers* polypetalous

* Pome—a capsule surrounded by a fleshy covering.

(a), with regular, perigynous *stamens*, indefinite in number (*b*): innate, two-celled *anthers*: a superior, solitary, simple *ovarium*, with a terminal *style* (*b*): *fruit* a drupe (*e*): *seed* exalbuminous, suspended: cotyledons thick (*d*).

Geo. position: Temperate zone.

Demulsive and laxative:

Amygdalus *communis*. Prunus *domestica*.
Prunus *Persica*.

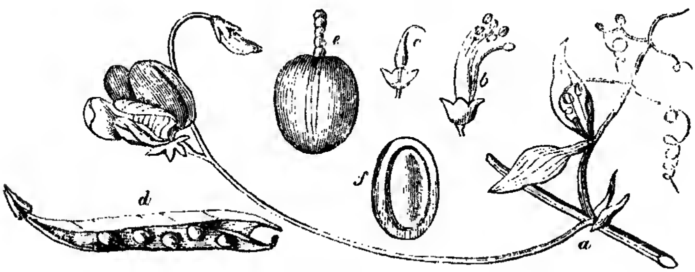
Yielding Tannic acid,—astringent:

Prunus *spinosa*.

Yielding a sedative principle (Hydrocyanic Acid):

Cerasus *Lauroecrasus*. * Cerasus *Capricida*.
* ——— *Virginiana*. Amygdalus *Amara*.
* ——— *Padus*. ——— *Persica*.

ORD. 110. LEGUMINOSÆ.—Trees, shrubs, and herbs with



alternate, stipulate leaves (*a*): *flowers* polypetalous, with perigynous *stamens*, monodelphous or diadelphous (*b*): *ovary* solitary, simple, superior (*c*): *style* terminal: *fruit* leguminous (*d e*): *seed* destitute of albumen (*f*).

Geo. position: Equinoctial zone and both hemispheres beyond the tropics, but chiefly in the north.

Yielding a saccharine matter:

Glycyrrhiza *glabra*. * Abrus *precatorius*.
* Alhagi *Maurorum*.

acids:

Tamarindus *Indica*.

Gum:

Acacia *vera*. * Acacia *Senegal*.
——— *Arabica*. Astragalus *Tragacantha*.
* ——— *gummifera*. ——— *verus*.
* ——— *Seyal*. * ——— *Creticus*.
* ——— *tortilis*. * Inga *fagifolia*.
* Prosopis *iuliflora*. * ——— *gummifer*.

Cathartine—a purgative principle:

Cassia *Senna.*	Cassia *elongata.*
—— *obovata.*	—— *lanceolata.*
—— *Æthiopica.*	* —— *Marilandica.*
* —— *Tora.*	Cathartocarpus *fistula.*
* Colutea *arborescens.*	* Coronilla *Emerus.*

an acrid principle—emetic, diuretic:

Geoffræa *enermis.*	Cytisus *Scoparius.*
* Baptisia *tinctoria.*	* Anthyllis *Hermannia.*

* Tephrosia *toxicaria.*

a mechanical acrid:

Mucuna *pruriens.*

an astringent principle; Tannic acid?

Hæmatoxylon *Campechianum.*	* Peterocarpus *Draco.*
* Butia *frondosa.*	—— *Santalinus.*
Acacia *Catechu.*	—— *erinaceus.*
* Inga *unguis.*	* —— *Marsupium.*

Yielding oleo-resin:

* Copaifera *Jacquini.*	* Copaifera *multijuga.*
—— *Langsdorfii*	* —— *coriacea.*

Balsam:

Myrospermum *peruiferum.* Myrospermum *toluiferum.*

ORD. 119. ANACARDIACEÆ.—Trees or shrubs with alter-

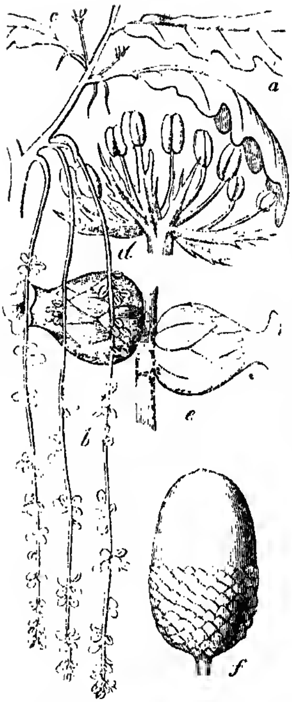
nate, exstipulate leaves, without pellucid dots: *flowers* polypetalous, unisexual *(a a b c)*: *calyx* small, persistent: *petals* perigynous, imbricated in æstivation (*d*): *stamens* alternate, with petals, part sterile: *ovarium* superior, simple: *fruit* indehiscent, commonly drupaceous: *seeds* solitary, exalbuminous.

Geo. position: Within the tropics and Temperate zones.

Yielding volatile oil—stimulant:

Rhus *Toxicodendron.*	* Anacardium *occidentale.*
* —— *venanata.*	Pistacia *Terebinthus.*
Pistacia *Lentiscus.*	* Stagmaria *verniciflua.*

* Semecarpus *Anacardium.*



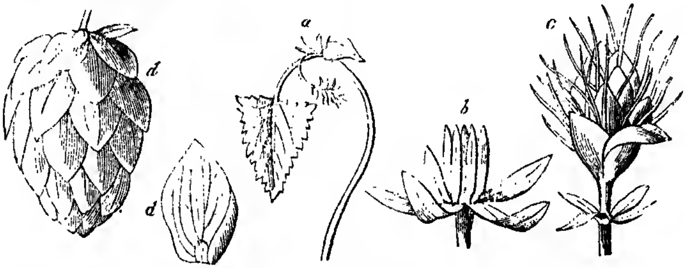
ORD. 120. CORYLACEÆ OR CUPULIFERÆ. — Trees or shrubs with simple, alternate, stipulate leaves *(a)*, with straight veins from midrib to margin : *flowers (b e)* are unisexual, amentaceous, diœcious, apetalous; *male* 8-20 stamens *(d)*; *female*, ovaries crowned by the rudiments inclosed in a scaly coriaceous involucre *(e)*: the calyx consisting of 6 minute, sharp, downy segments; the *ovary* globose; *style* short, conical; *stigmas* 3 obtuse, recurved; *fruit*, a horny or coriaceous nut, seated in a cupule or involucre, *(f)*.

Geo. position: Temperate zones.

Yielding astringent principles; Tannic acid:

Quercus *Robur* or *pedunculata*.
——— *sessiliflora*.
——— *Infectoria*.
* ——— *coccifera*.
* ——— *falcata*.

ORD. 126. URTICACEÆ.—Trees or shrubs with alternate,



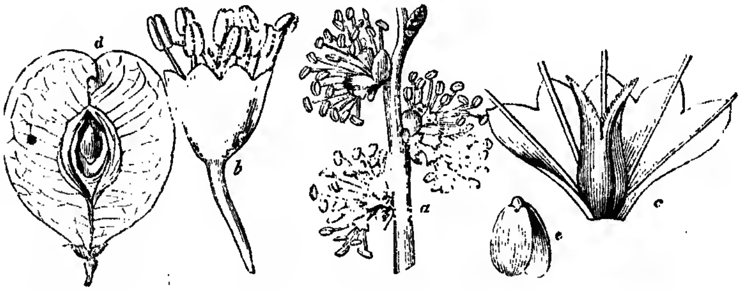
scabrous, stipulate, sometimes lactescent, leaves *(a)*: *flowers (b c)* monœcious or diœcious, apetalous, solitary, or clustered: *stamens* definite, distinct, inserted into the tube of the *calyx (b)*, turned back with elasticity: *ovarium* superior, simple, two-celled: *fruit*, a nut, indehiscent, achenium attached to the base of each membranous scale (*c*) of the catkin *(d)*, covered with roundish aromatic glands, or lupuline.

Geo. position: General over the globe.

Yielding a bitter principle, Lupuline—demulsive, narcotic.

Humulus *Lupulus*.	Ficus *Carica*.
* Urtica *dioica*.	* —— *racemosa*.
Morus *nigra*.	* Cannabis *sativa*.
* —— *alba*.	* Dorstenia *Brasiliensis*.
* Ficus *Indica*.	——— *Contrayerva*.

ORD. 127. ULMACEÆ.—Trees and shrubs with alternate,

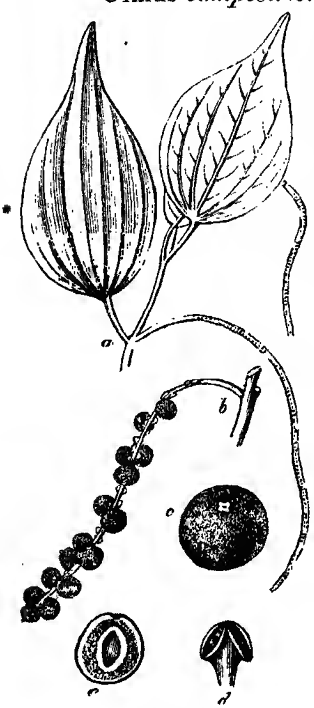


scabrous, simple, stipulate leaves: *flowers* bisexual (*a b*), apetalous, solitary, or loosely clustered (*a*), with definite *stamens* inserted into the base of the *calyx* (*b c*): *ovarium* superior, one-celled, (*c*), with suspended *ovules*: *fruit* one or two-celled, indehiscent, membranous (*d*), or drupaceous: *seeds* pendulous, exalbuminous (*e*).

Geo. position: Europe, Asia, North America.

Yielding Ulmin:

Ulmus *campestris*. * Ulmus *glabra*.



ORD. 136. PIPERACEÆ.—Shrubs or herbaceous plants with alternate, distichous, exstipulate leaves (*a*): *flowers* achlamydeous*, with *stamens* on short filaments (*d*) adhering to the base of the *ovarium*, which is superior, one-celled, crowned with a sessile *stigma*: *fruit* on a central axis (*b*), superior, fleshy, indehiscent (*c*), one-celled: *seed* erect: *embryo* enclosed in a sac (*c*).

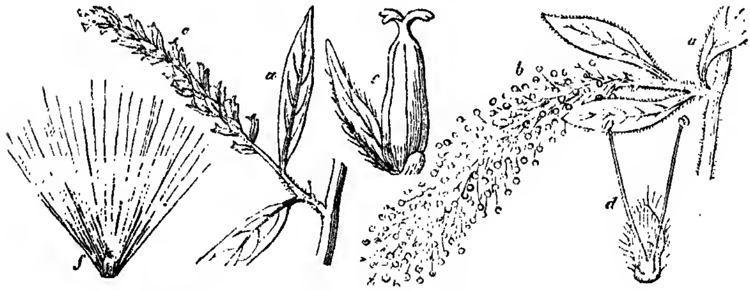
Geo. position: Indian Archipelago.

Yielding Piperina and volatile oil—excitant.

Piper *nigrum*.
* —— *methysticum*.
—— *longum*.
* —— *sylvaticum*
* —— *Anisitum*.
—— *Cubeba*.
* Piperomia *umbellata*.

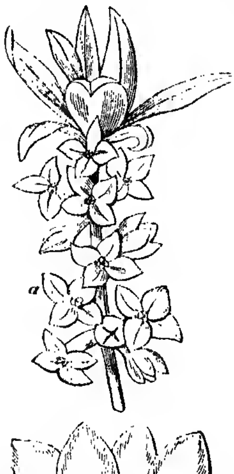
* Flowers in which the *calyx* and *corolla* are absent.

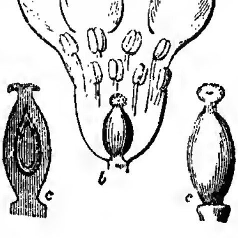
ORD. 137. SALICICACEÆ. — Trees or shrubs with simple,



alternate, stipulate, frequently glandular leaves *(a)*: *flowers* achlamydeous, unisexual *(b, male—c, female amentum)*: *stamens* attached to a bract *(d)*, amentaceous: *ovarium* superior *(e)*, one or two-celled: *fruit* coriaceous: *seeds* indefinite, comose* *(f)*.

Geo. position: Europe, Northern Asia, North America.





Yielding Salicina and Tannic acid—tonic:

Salix *fragilis*. * Salix *purpurea*.
—— *Caprea*. * Populus *tremula*.
*—— *Russelliana*. ——— *balsamifera*.
—— *Alba*. * ——— *nigra*.
*—— *pentandra*. * ——— *candidans*.
* Populus *laurifolia*.

ORD. 146. THYMELACEÆ.—Shrubs with entire, exstipulate *leaves*, alternate and opposite: *flowers* apetalous, with a tubular four or five-cleft, coloured persistant *(a)*: *stamens* definite in the floral tube or orifices of the perianth: *style* single *(b)*: *ovarium* single, superior, one-celled *(c)*: *fruit* indehiscent, baccate or drupaceous; pulpy, or hard and dry: *ovules* pendulous: albumen none, or very little: embryo straight.

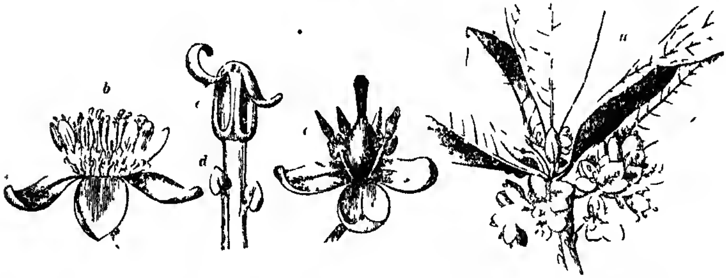
Geo. position: Europe, Cape of Good Hope, New Holland.

Yielding an acrid principle and an alkali:

Daphne *Mezereum*.
* ——— *Laureola*.
* ——— *Gnidium*.
* Dirca *palustris*.
* Lagetta *lintearia*.

* Comose—having appendages consisting of long hairs.

ORD. 150. LAURACEÆ.—Trees with entire, alternate leaves,



ribbed, devoid of stipules: unisexual or bisexual *flowers (a)*, apetalous, with a 4-6 cleft *calyx*, and definite perigynous* *stamens*, some of which are generally abortive *(b)*: *anthers* adnate, 2-4 cells, which open by recurved valves *(c)*: *glands* at the base of the inner filaments *(d)*: *fruit* baccate or drupaceous†, containing seeds without albumen.

Geo. position: Both hemispheres, except in Africa.

Yielding an aromatic volatile oil:

Laurus *Cinnamomum*, seu Cassia *Zeylanicum*.

* Cassia *Culilawan*.	Cassia *Javanicum*.
* ——— *aromaticum*.	* ——— *Tamala*.
* ——— *rubrum*.	* ——— *Sintoc*.
* ——— *nitidum*.	Laurus *Nobilis*.

Laurus *Sassafras*, seu Sassafras *officinale*.

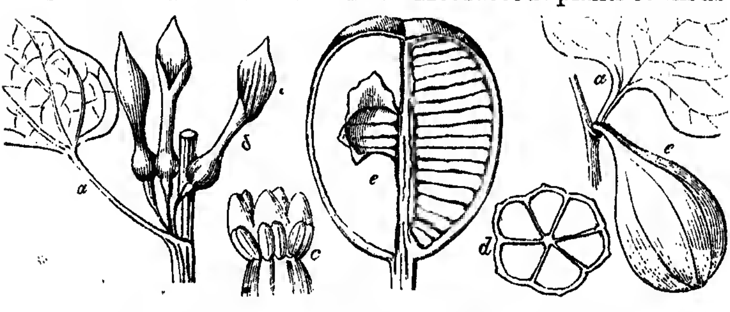
Yielding Camphor.

Laurus *Camphora*, seu Camphora *officinarum*.

* Persea *gratissima*.	* Caryodaphne *densiflora*.
* Mespilodaphne *pretiosa*.	* Nectandra *Cinnamomoides*.
* Aydendron *Cujumary*.	* ——— *Puchurymajer*.
* ——— *laurel*.	* Dicypellium *caryophyllatum*.

Benzoin *oderiferum*.

ORD. 155. ARISTOLOCHIACEÆ.—Herbaceous plants or shrubs,



often climbing, with alternate, simple, petiolate leaves‡ *(a)*

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* Perigynous—stamens rising from the same plane as the female parts.
† Drupe—a nut surrounded by a fleshy matter, as in the cherry.
‡ The leaves are "often with leafy stipules."

flowers apetalous, often large and specious, consisting of a superior, tubular, valvate *calyx:* epigynous *stamens* (*c*); 3-6 celled *ovarium* (*d*): *fruit* (*e*) many seeded.

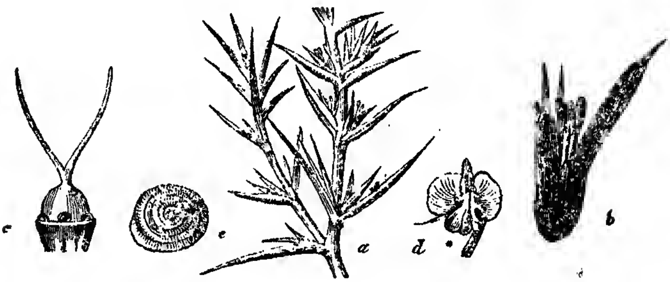
Geo. position: Europe, both Americas, India.

Yielding a stimulant bitter principle:

* Aristolochia *Serpentaria.*	* Aristolochia *bracteata.*
* ——— *Indica.*	* ——— *grandiflora.*
* ——— *cymbifera.*	* ——— *Clematitis.*
* ——— *macroura.*	* ——— *fragrantissima.*
* ——— *trilobata.*	* ——— *anguicida.*
* ——— *rotunda.*	Asarum *Europæum.*

* Asarum *Canadense.*

Ord. 157. Chenopodiaceæ.—Herbaceous plants or under-



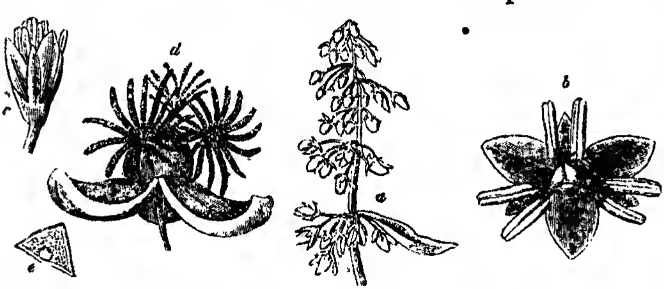
shrubs, with alternate, exstipulate leaves, and small flowers (*a*); *calyx* persistent, tubular at the base (*b*); with the *stamens* inserted at the base; *ovary* superior (*c*); *fruit* membranous (*d*); *embryo*, either curved, round, or spiral (*e*), farinaceous albumen, or doubled together without albumen.

Geo. position: Europe, Egypt, America.

Yield a bitter and an alkaline principle.

* Chenopodium *olidum.*	* Salsola *kali.*
* ——— *Botrys.*	* ——— *sativa.*
* ——— *ambrosioides.*	* ——— *soda.*
* ——— *anthelminticum.*	* Atriplex *angustifolia.*

Ord. 160. Polygonaceæ.—Herbaceous plants and a few



shrubs, with alternate, stipulate, orchreated leaves: *flowers*, in

many instances, in racemes, apetalous (*a*): *stamens*, definite, inserted at the bottom of the *calyx* (*b*), which is inferior and imbricated (*c*); *ovarium*, superior (*d*), with a single, erect nut; triangular *seeds*: with farinaceous albumen (*e*), and a *radicle* remote from the hilum.

Geo. position: General over the globe.

Yielding a purgative and an astringent principle:

Rheum *palmatum*. * Rheum *leucorhizum*.
——— *Australe*. * Rumex *obtusifolius*.
* ——— *rhaponticum*. * ——— *Aquaticus*.
——— *undulatum*. * ——— *crassinervium*.

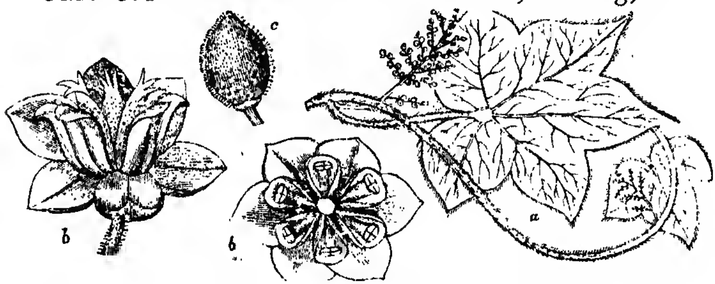
An acidulous salt.

Rumex *acetosa*.

an astringent principle:

Polygonum *bistora*. * Polygonum *barbatum*
* ——— *amphibium*. * Coccoloba *uvifera*.

Ord. 164. Menispermaceæ.—Flexible, twining, shrubs,



with alternate leaves (*a*): small polypetalous, racemose, unisexual flowers (*b* female, *b* male), with hypogenous *stamens* opposite to the petals, supporting on their points adnate *anthers*. *Fruit*, a one-seeded drupe (*c*).

Geo. position: Tropics of Asia and America.

Yielding a bitter and diuretic and a tonic principle, Columbina.

Cocculus *palmatus* (Calumba).
Cissampelos *Pareira*.
* ——— *ovalifolia*.
* Abuta *rufescens*.
* ——— *acuminatus*.
* Pereiria *medica*.

a narcotic principle:

Anamirta *Cocculus*.

Ord. 166. Pyrolaceæ.—Herbaceous plants, with simple, entire, or toothed leaves: *flowers* in terminal racemes, monopetalous, regular, deciduous: *stamens* hypogynous, double the number of the *petals*, bearing two-celled dry *anthers*, with appendages: *ovarium* superior, many-seeded, with a single declinate *style*: *seeds* winged: *embryo* minute, invested in fleshy albumen.

Geo. position: Europe, North America, Northern Asia.
Yielding a diuretic stimulant principle:
Chimaphila *corymbosa.*

ORD. 168. ERICACEÆ. — Shrubs, or under shrubs, with

evergreen, rigid, entire, whorled, exstipulate leaves (*a*): *flowers* (*b*) monopetalous, regular: *calyx* (*c*) persistent, inferior, 4-5 cleft: *corolla* (*c*) hypogynous, 4-5 cleft, imbricated: *stamens* definite, hypogenous: *anthers* two-celled (*d*), dry, with appendages, dehiscing with a pore: *ovarium* (*e*) superior, one style, many-seeded: *fruit* succulent (*f*): *seeds* indefinite, with the *embryo* in the *axis* of the albumen.

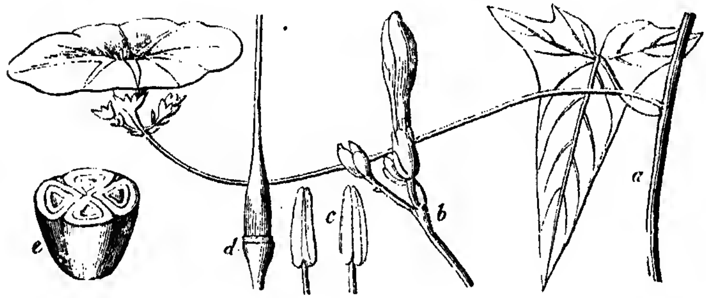
Geo. position: Europe, America, Cape of Good Hope.
Yielding an astringent principle:
Arctostaphylos *uva-ursi.* * Loiscleuria *procumbens.*
a stimulant principle:
Rhododendron *Chrysanthum.* * Rhododendron *maximum.*

ORD. 174. STRYACEÆ. — Trees or shrubs with alternate,

coriaceous leaves (*a*): *flowers* (*b*) solitary or clustered, monopetalous: *calyx* 3-6 divisions: *corolla* (*c*) hypogenous, imbricated, deeply cleft; *stamens* perigenous, definite, as many, or three or four times as many, as the segments of the corolla: *ovarium,* containing several *cells,* having 1 or 2 *ovula: style* simple, obtuse: *fruit* (*d, e*) a dry drupe: albumen cartilaginous, with embryo in the axis.

Geo. position: Asia, North and South America.
Containing Benzoic Acid, and an Oleo-resin:
Styrax *officinale.* *Styrax* Benzoin.

ORD. 177. CONVOLVULACEÆ.—Herbaceous plants with alter-



nate, undivided, exstipulate leaves (*a*): *flowers* (*b*) axillary, or terminal, monopetalous, regular: *calyx* persistent: *corolla* hypogynous, deciduous, plaited: *stamens* (*c*) inserted into the base of the corolla: *ovarium* (*d*) simple, superior, 2-4-celled (*e*): *ovules* definite and erect: *style* divided: *stigmas* obtuse or acute: *seeds* albuminous.

Geo. position: Tropical climates, rare in cold climates.

Yielding a resinous purgative principle:

* Pharbitis *nil.*	Ipomea *purga* (*Jalapa*).
* Convolvulus *Althæoides.*	* ——— *Turpethum.*
——————— *Scammonia.*	* ——— *Orizabensis.*
* Ipomea *cathartica.*	* ——— *tuberosa.*

ORD. 182. LOBELIACEÆ. — Herbaceous plants or shrubs

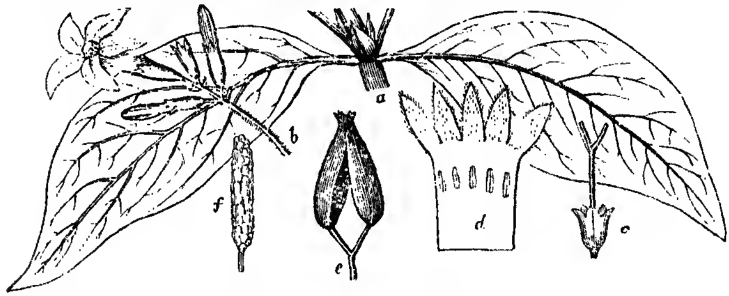
with alternate exstipulate leaves (*a*): *flowers,* in racemose spikes (*b*). *Calyx* (*c*) five-lobed or entire: *corolla* (*d*) irregular, three-lobed or five-cleft: *stamens* (*e*) five, with cohering anthers: *stigma* (*e*) fringed: *fruit* (*f*) capsular, with one or more cells, and many seeds: embryo in the axis of the albumen.

Geo. position: North America: West Indies.

Yielding narcotic and emetic principles:

Lobelia *inflata.*	* Hippobroma *longifolia.*
* ——— *syphilitica.*	

ORD. 189. CINCHONACEÆ.—Trees, shrubs or herbs, with simple, opposite or verticillate leaves, and interpetiolar *stipules (a): flowers* monopetalous in panicles (*b*): *calyx* (*c*) superior, simple, with connate bractes at its base: *corolla* (*d*) tubular, regular, with definite divisions of the limb: *stamens* adhering to the corolla on the same line: *ovarium* inferior, crowned with a



disk: *ovules* numerous: *style* single, with a sometimes divided *stigma* (*e*): *fruit* inferior, either splitting (*e*) into two cocci* or indehiscent: *seeds* attached to central *axis* (*f*), when indefinite; when definite, erect: *embryo* small, albuminous.

Geo. position: Within the tropics, especially in South America.

Yielding tonic principles; Quina, Cinchonia, Aricina.

Cinchona *Condaminea*. Cinchona *nitida*.
——— *michrantha*. ——— *ovata*.
——— *hirsuta*. ——— *magnifolia*.
——— *lanceolata*. * Portlandia *hexandra*.

a diuretic principle:
* Chiococa *densifolia*.

an emetic principle; Emetia:
Cephaelis *Ipecacuanha*. * Richardsonia *scabra*.
* Psychotria *emetica*. ——— *rosea*.
* Geophila *uniformis*. * Borreria *ferruginea*.

astringent matter; Tannic Acid:
* Uncaria *Gambeer*. * Condaminea *corymbosa*.
* ——— *speciosa*. * Coffea *Arabica*.
* Gardenia *campanulata*. * Canthium *parviflorum*.

ORD. 191. CAPRIFOLIACEÆ.—Shrubs or herbaceous plants with opposite, exstipulate leaves: *flowers* corymbose, monopetalous, with a superior bracteated *calyx*, and a rotate or a tubular *corolla*: *stamens* alternating with the lobes of the corolla: *ovarium* inferior, many celled: *ovules* pendulous: *fruit* indehiscent: *seeds* solitary and pendulous, or numerous and attached to the *axis*.

* Coccum—a peculiar kind of seed vessels which opens with an elastic spring.

Geo. position: Northern Europe, Asia, and America.

Yielding a laxative principle:

Sambucus *nigra*.
* ——— *Ebulus*.
* Triosteum *perfoliatum*.

a tonic principle:

Cornus *florida*.

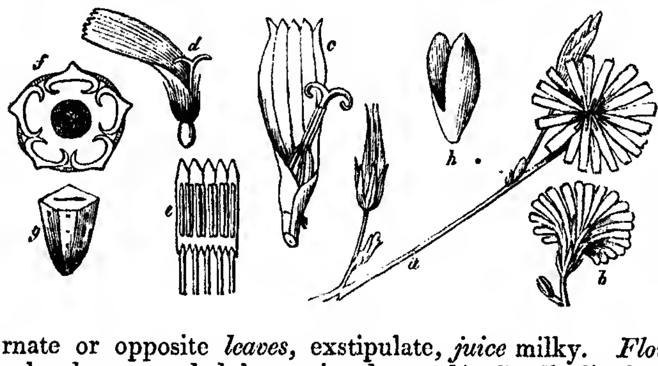
ORD. 192. STELLATÆ. — Herbaceous plants with whorled exstipulate scabrous leaves, and quadrilateral stems: *flowers* small, monopetalous: *corolla* rotate or tubular, inserted into the *calyx* which is 5-6 lobed: *stamens* definite, alternating with the segments of the *corolla*: *ovarium* two-celled: *ovules* solitary: *fruit* inferior, didymous, indehiscent; *seeds* erect, embryo straight, in horny albumen.

Geo. position: Northern parts of the northern hemisphere.

Yielding a colouring, stimulant principle:

Rubia *tinctorum*.

ORD. 195. CHICORACEÆ. — Herbaceous plants *(a)*, with



alternate or opposite *leaves*, exstipulate, *juice* milky. *Flowers* in a head surrounded by an involucre *(b)*, *Corolla* ligulate or one-lipped *(c, d)*; *stamens* (*e*) united in a tube (*f*), surrounding the style; *seed* crest *(g)*; albumen absent *(h.)*

General position. Common over Europe.

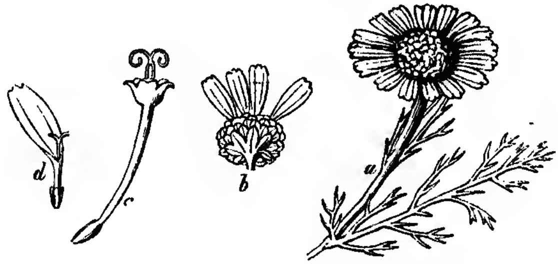
Yielding a bitter principle:

Taraxacum *dens Leonis*.
Chicorium *Intybus*.

a narcotic principle:

Lactuca *virosa*.
——— *sativa*.

ORD. 196. ASTERACEÆ or CORYMBIFERÆ.—Herbaceous plants, with *leaves* and *flowers (a)*, as in Chicoraceæ; but with



the involucre (*b*) hemispherical; ray flowers tubular *(c)*, florets of the ray, if present, *(b, d)* ligulate; *seed* erect; albumen absent.

General position. Common over Europe.

Yielding a narcotic, and bitter.

Tusilago *Farfara.*

Volatile oil, a tonic bitter principle.

Inula *Helenium.*
* Artemisia *Indica.*
———— *Abrotanum.*
———— *Absinthium.*
Tanacetum *vulgare.*
* Arnica *montana.*
* Solidago *adora.*
* Baccharis *genistelloides.*
* Pyrethrum *Parthenium.*

an acrid oil.

Anacyclus *Pyrethum.*

Volatile oil and Piperina—antiperiodic.

Anthemis *nobilis.*
* Eupatorium *perfoliatum.*
* Maruta *Cotula.*
* Ptarmica *vulgaris.*
* Santolina *fragrantissima.*
* Emilia *sonchifolia.*

Stimulant Tonic.

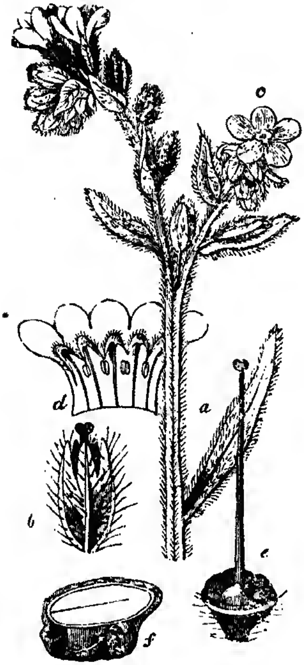
* Mikania *Guaco.*

ORD. 199. VALERIANACEÆ.—Herbs with opposite, exstipulate leaves: *flowers* corymbose, panicled, or in heads, monopetalous: *calyx* superior, membranous: *corolla* tubular, some calcarate at the base: *stamens* 1-3 distinct: *ovarium* inferior, two-celled: *ovules* solitary, pendulous: *fruit* dry, indehiscent: *seeds* exalbuminous.

Geo. position: Temperate zones, but uncommon in Africa and North America.

Yielding a stimulant fœtid oil:

Valeriana *officinalis.*
* ———— *Dioscorides.*



ORD. 208. BORAGINACEÆ.—Herbaceous plants or shrubs, with alternate leaves covered with asperities (*a*): *calyx* persistent, with 4-5 divisions (*b*): *corolla* monopetalous, hypogynous, regular (*c*): *stamens* inserted within the petal (*d*): *ovarium* superior, deeply lobed (*e*): *style* simple: *seeds* destitute of albumen (*f*).

Geo. position: Temperate zone of the northern hemisphere.

Yielding a mucilaginous colouring matter:

* Borago *officinalis*.
* Symphytum *officinale*.
  Anchusa *tinctoria*.
* Trichodesma *Zeylanica*.
* Cynoglossum officinale.

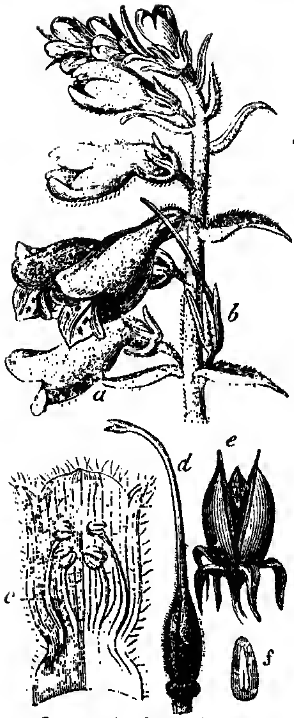
ORD. 209. LABIATÆ.—Herbaceous plants, or undershrubs, with quadrilateral stems and opposite, exstipulate leaves, replete with volatile oil: *flowers* irregular, unsymmetrical in opposite, nearly sessile, axillary cymes, sometimes solitary (*a*): *calyx* inferior, tubular, persistent (*b*): *corolla* monopetalous, hypogynous, bilabiate (*c*): *stamens* four, didymous, inserted in the corolla (*d*): *anthers* celled: *ovarium* deeply four-lobbed (*e*): *style* proceeding from the base of the lobes of the ovarium (*f*): *fruit* 1-4 small nuts in the persistent calyx: *seeds* erect.

Geo. position: Temperate zones, between parallels of 40° and 50° north latitude.

Yielding volatile oil:

Hyssopus *officinalis*.
Lavandula *spica*.
———— *vera*.
Marrubium *vulgare*.
Melissa *officinalis*.
Mentha *piperita*.

Mentha *pulegium.*
Origanum *vulgare.*
———— *majorana.*
Rosmarinus *officinalis.*
Salvia *officinalis.*
* Amaracus *Dictamnus.*
* Leonorus *Cardiaca.*
* Anisomeles *malabarica.*
* Hedeoma *pulegioides.*



ORD. 221. SCROPHULARIACEÆ.—Chiefly herbaceous plants with opposite or alternate exstipulate leaves: *flowers* monopetalous, irregular, unsymmetrical (*a*): *calyx* divided, persistent (*b*): *corolla* hypogynous: *stamens* didymous (*c*): *ovarium* superior, two-celled (*d*): *fruit* capsular, superior, two-celled (*e*): *seed* albuminous: *embryo* in a fleshy albumen (*f*): radicle orthotropous*.

Geo. position: General over the globe.

Yielding a Cathartic principle:
Gratiola *officinalis.*
* Scrophularia *nodosa.*
* ———— *aquatica.*

a narcotic, diuretic principle:
Digitalis *purpurea.*
* Euphrasia *officinalis.*
* Herpestes *Monniera.*
* Picrorhiza *Kurroa.*

ORD. 222. SOLANACEÆ.—Herbaceous plants or shrubs with alternate leaves: *flowers* monopetalous, regular: *calyx* inferior, five-parted, persistent: *corolla* monopetalous, plaited, hypogynous, deciduous: *stamens* inserted into the corolla: *anthers* bursting longitudinally, and by pores at the apex: *ovarium* two-celled, with two polyspermous placentæ: *ovules* indefinite: *stigma* simple: *fruit* succulent: *seeds* numerous, sessile: *embryo* curved, lying in fleshy albumen.

Geo position: General, but especially within the tropics.

Yielding narcotic principles:
Atropa *Belladonna.* * Nicotiana *rustica.*

* Orthotropous—when a straight embryo lies in a direction the opposite to that of the grain.

Datura *Strammonium.*
* ——— *ferox.*
* ——— *Tatula.*
Hyoscyamus *niger.*
Nicotiana *Tabacum.*
* Nicotiana *Persica.*
Solanum *Dulcamara.*
Physalis *somnifera.*
* ——— *nigrum.*
* ——— *cernuum.*

an acrid principle:
Capsicum *annuum.*
* ——— *frutescens.*

Demulcent mucilage:
Verbascum *thapsus.*

Ord. 224. Gentianaceæ.—Herbaceous plants with opposite, entire, sessile, exstipulate leaves (*a*): *flowers* terminal, axillary: *calyx* monophyllous, persistent: *corolla* (*b*) hypogynous, imbricate, withering, monopetalous: *stamens* inserted into the corolla, some abortive: *ovarium* (*c*) single, superior, celled: *style* continuous: *stigma* simple or bifid: *fruit* a many-seeded berry.

Geo. position: General over the globe.

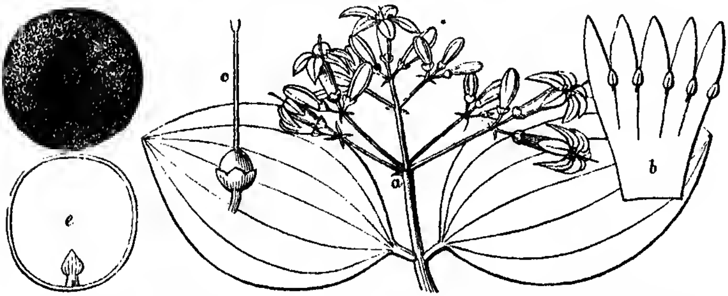
Yielding bitter tonic principles:
Agathotes *Chirayta.*
* Frazera *Carolinensis.*
* Sabbatæ *angularis.*
Chironia *Centaurium.*
Menyanthes *trifoliata.*
Gentiana *lutea.*
* ——— *pannonica.*
* ——— *Campestris.*
* ——— *Catesbæi.*
* ——— *Amarella.*
* ——— *purpurea.*
* ——— *punctata.*
* ——— *kurroo.*

Ord. 225. Spigelaceæ.—Herbs or under-shrubs with opposite, entire, stipulate leaves: *flowers* regular, monopetalous, valvate: *stamens* five, inserted into the corolla in one line: *pollen* three-cornered, with globular angles: *ovarium* superior, two-celled: *fruit* capsular, two-celled, two-valved: *seeds* several, small, with a single testa: *embryo* minute, lying in a thick fleshy albumen: radicle pointing to the hilum.

Geo. position: North America, within the southern tropic.

Yielding an acrid principle:
Spigelia *Marilandica.*

ORD. 226. APOCYNACEÆ.—Milky trees or shrubs, with



opposite, somewhat whorled, exstipulate leaves (*a*), with glands on the petioles: *infloreseence* corymbose: *flowers* regular, with a contorted corolla: *stamens* (*b*) arising from the corolla, alternate with its segments: *pollen* powdery: *ovarium* superior, double; the apex connected by a common, simple stigma (*c*): *seeds* (*e*) with a fleshy albumen, foliacious embryo, and radicle turned towards the hilum.

Geo. position: Africa, India, New Holland, North America.

Yielding Strychnia: Tonic—excitant.

Strychnos *Nux vomica.*
* ——— *toxifera.*
——— *St. Ignatia.*
* ——— *Colubrina.*
* ——— *seudognina.*
* ——— *Tieute.*

Yielding an excitant principle, cathartic, emetic.

* Allamanda *cathartica.*
* Vinca *pusilla.*
* Apocynum *androsæmifolium.*
* Hasseltia *arborea.*
* Plumiera *acutifolia.*
* ——— *drastica.*

ORD. 227. ASCLEPIADACEÆ.—Shrubs with entire, oppo-

site, sometimes alternate leaves, (*a*): *flowers* regular, in umbels,

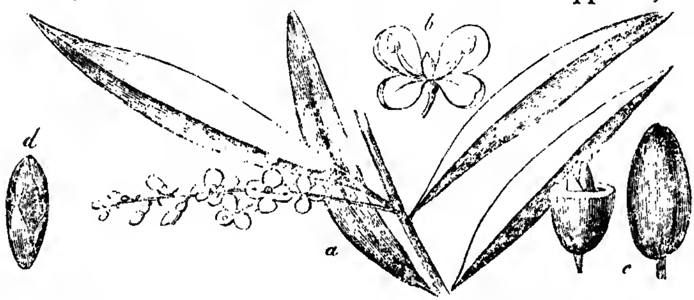
racemes, or fascicles: *calyx* (*c*) persistent: *corolla* (*b*) monopetalous, hypogynous, regular, deciduous: *stamens* (*d*) five, alternate with segments of the limb: *anthers* two-celled: *pollen* (*d*) cohering in masses: *ovaria* two: *styles* two: *follicles* (*e*) two.

Geo. position: Africa, India, New Holland, eastern side of North America.

Yielding an acrid principle:

* Tylophora *asthmatica.*
* Sarcostemma *glaucum.*
* Hemidesmus *Indicus.*
* Secamone *Alpini.*
* Asclepias *gigantia.*
* Cynandrum *oleofolium.*
* ———— *vincetoxicum.*
* ———— *monspeliacum.*

ORD. 230. OLEACEÆ.—Trees or shrubs with opposite, sim-



ple, or pinnated leaves (*a*): *flowers* regular (*b*), monopetalous, hermaphrodite, or diœcious: *calyx* monophyllous, inferior, persistent: *corolla* (*b*) hypogynous, 4-cleft, valvate, sometimes apetalous: *stamens* (*b*) two: *ovarium* (*c*) simple, superior, two-celled: *seeds* (*d*) pendulous.

Geo. position: Temperate zones.

Yielding a fixed oil:

Olea *Europea.*

ORD. 233. CYCADACEÆ.—Trees with a cylindrical trunk, increasing by a terminal bud: *leaves* pinnated, gyrate: *flowers* diœcious; *males* monandrous, in sessile cones; *females* in cones or in form of contracted leaves: ovules solitary, naked; embryo embedded in the axis of fleshy albumen.

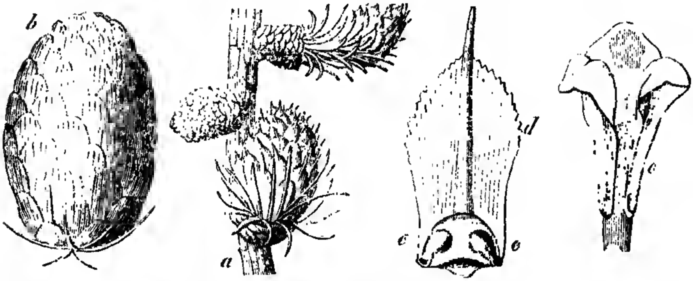
General position: Japan, Moluccas.

Yielding Gum and Fecula.

Cycas *revoluta.*
—— *circinalis.*

CLASS II. GYMNOSPERMÆ.

ORD. 234. CONIFERÆ. — *Trees or shrubs with a stem*



abounding with resin: linear, accrose, or lanceolate entire leaves, sometimes fascicled; *flowers* monœcious or diœcious; male monandrous or monodelphous, collected in a deciduous amentum (*a*); female in cones (*b*): *anthers* two-lobed (*c*): *pollen* large, usually compound: *ovarium*, a flat scale (*d*): *ovules* at the base of the bractial scales, inverted (*e e*): *fruit*, a cone: *seeds* with a hard crustaceous tegument: *embryo* in an oily albumen, with two or many opposite cotyledons.

Geo. position: Temperate climates, the arctic circle, and the hottest regions of the Indian Archipelago.

Yielding a resinous volatile oil, turpentine:

Callitris *quadrivalvis.*	Abies *Picea.*
Pinus *Pinaster.*	——— *balsamea.*
——— *sylvestris.*	Juniperis *communis.*
——— *Pumilio.*	————— *Sabina.*
Abies *Larix.*	————— *virginiana.*

MONOCOTYLEDONS, OR ENDOGENOUS PLANTS.

TRIBE I. PETALOIDEÆ.

ORD. 237. ZINGIBERACEÆ. SCITAMINEÆ.—Herbaceous aromatic plants with a creeping *rhizoma**, and a stem formed of bases of the leaves, never branching: *leaves* simple, sheathing, having a single midrib, whence numerous veins diverge at an acute angle: *flowers* tripetaloideous: *calix* superior, tubular: *corolla* irregular, with six segments in two whorls: *stamens* three, distinct, two abortive, the intermediate one fertile: *filament* not petaloid: *anther* two-celled, its lobes often embracing the upper part of the style: *pollen* globose, smooth: *stigma* dilated, hollow: *fruit* capsular, sometimes berried, three-celled, many seeded: *seeds* roundish or angular, with or without an arillus, and the embryo enclosed within a vitellus.

Geo. position: Tropical climates.

Yielding an aromatic volatile oil:

Zingiber *officinale.*	* Elettaria *medium.*
Alpinia (Elettaria) *Cardamomum.*	Amomum *aromaticum.*

* Rhizoma—a part of the stem which is sometimes underneath the soil, and always emits radicles.

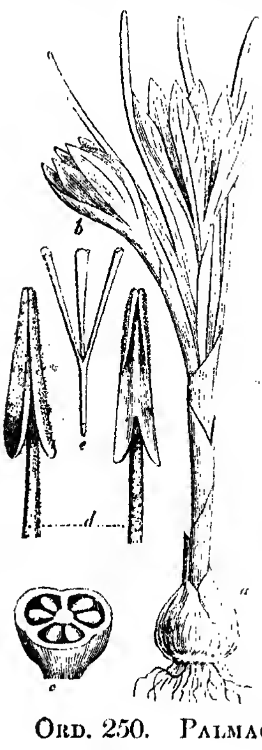
* Amomum *Zedoaria*. Curcuma *longa*.
——— *maximum*.

Ord. 238. Marantaceæ.—Herbaceous plants, not aromatic: *inflorescence* terminal, expanded, with glumaceous deciduous bracts: *calyx* superior, three sepals: *corolla* irregular, segments in two whorls: *stamens* three, one of which is usually abortive: *filament* petaloid: *anther* two-celled: *stigma* cucullate, incurved: *seeds* without an aril.

Geo. position: South America, West Indies.

Yielding a pure fecula.

Maranta *arundinacea*. Canna *edulis*.



Ord. 244. Iridaceæ.—Herbaceous plants, or under-shrubs; tuberous and fibrous roots (*a*), with equitant leaves: *inflorescence* terminal, in spikes, corymbs, panicles, or crowded: triandrous *flowers* (*b*): *stamens* three, arising from the base of the sepals: *filaments* (*d,d*) distinct or connate: *anthers* fixed by their base, two-celled, bursting externally lengthways (*d, d*): *ovarium* three-celled, many seeded (*c*): one *style*: *stigmas* often petaloid (*e*): *capsule* three-celled, three-valved: *seeds* attached either to a central column or parietal placentæ: *embryos* enclosed in albumen.

Geo. position: Cape of Good Hope, middle parts of North America, Europe; few within the tropics.

Yielding a volatile oil, and an acrid principle.

Crocus *sativus*.
——— *odorus*.
Iris *Florentina*.
* —— *versicolor*.
* —— *Pseud-acorus*.

Ord. 250. Palmaceæ.—Plants with an arborescent trunk

covered with the sheathing bases of decayed leaves: the *leaves* terminal, pinnate, or flabelliform (*a*): *inflorescence* hermaphrodite or polygamous, enclosed in a valved apatha* (*b*): *flowers* small, bracteolated, each a hexapetaloid, persistent *perianth*: *stamens* inserted into the base of the perianth, definite or indefinite in number: *ovarium* superior, three-celled (*c*): *ovule* erect: *fruit* baccate, or drupaceous (*d*), with fibrous flesh.

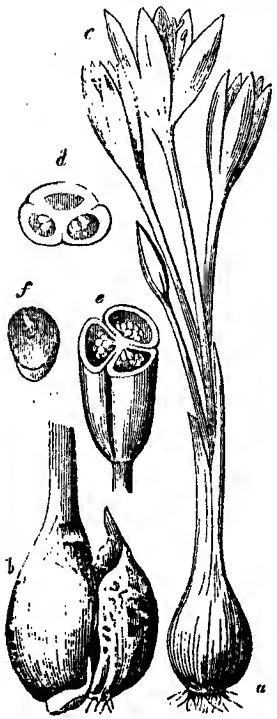
Geo. position: Tropical regions, except in South America and the west coast of New Holland.

Abounding in oil and amylaceous matter:

Sagus *farinifera*. Sagus *lævis*.

Yielding wax:

Ceroxylon *andicola*.



ORD. 252. MELANTHACEÆ.—Herbs with fibrous or fascicled roots (*a*): *rhizoma* sometimes fleshy (*b*): *leaves* sheathing at the base, with parallel veins: *flowers* hexapetaloideous, tubular (*c*): *stamens* six, with *anthers* turned inwards: *ovarium* three-celled, many-seeded (*d*): *style* trifid: *stigmas* undivided: *capsule* divisible into three pieces (*e*): *seeds* albuminous, with a membranous *testa* (*f*).

Geo. position: Europe, Cape of Good Hope, Asia, America, New Holland.

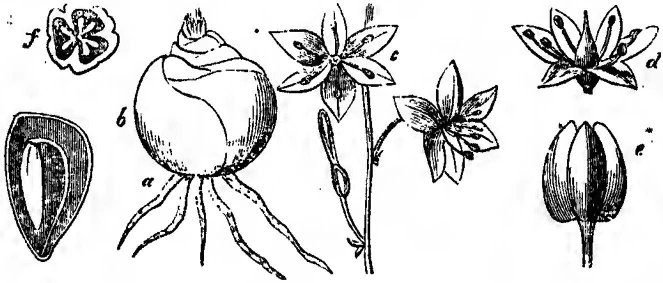
Yielding veratria, and colchicia.

Colchicum *autumnale*.
Veratrum *album*.
——— *Sabadilla*.
* ——— *viride*.
Helonias *officinalis*.
——— *dioica*.
* ——— *frigida*.
* ——— *erythrosperma*.
* Gyromia *virginica*.

ORD. 254. LILIACEÆ.—Herbaceous plants, with bulbs (*b*): tubers fibrous (*a*), or fascicled roots: *stem* none: *leaves* with parallel veins: *flowers* hexapetaloideous, the *perianth* regular (*c*), coloured: *stamens* six, hypogynous: *anthers* turned inwards (*d*)

* Spatha—a foliaceous floral covering, formed of one or more floral leaves.

ovarium superior, three-celled (*e*): *stigma* simple or three-lobed:



fruit three-celled (*f*): *seeds* numerous: *embryo* in the axis of fleshy albumen (*g*).

Geo. position: Temperate climates, widely scattered.

Yielding scillitina:

Scilla *maritima*. Scilla *Pancration*.

an acrid, oily principle:

Allium *sativum*. Allium *Cepa*.

Allium *Porrum*.

a bitter purgative principle:

Aloës *Spicata*. Aloës *vulgaris*.

Aloës *Soccotrina*.

Ord. 260. Smilaceæ. — Herbaceous plants, or climbing,

under shrubs, stems woody: *leaves* with reticulated veins (*a*): *flowers* hexapetaloideous, hermaphrodite, sometimes diœcious (*b*, *c*): *perianth* inferior, coloured: *stamens* six, inserted into the perianth (*b*): *anthers* turned inwards: *ovarium* three-celled, superior: *stigmas* three (*d*): *fruit* a berry (*e*), containing seeds with a membranous testa: *albumen* nearly cartilaginous.

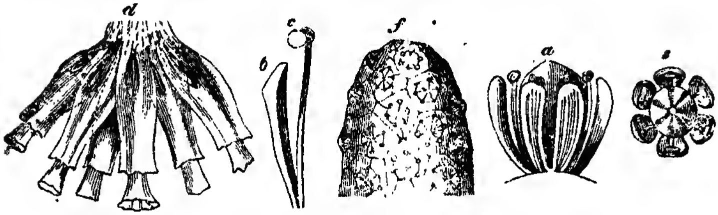
Geo. position: Asia, North America.

Yielding a mucilaginous, unknown principle:

Smilax *Sarsaparilla*. Smilax *Aspera*.

Smilax *China*.

ORD. 266. ACORACEÆ.—Herbaceous plants with leaves



sheathing at the base: *flowers* hermaphrodite (*a*), surrounded with scales (*b*): *stamens* with two-celled *anthers* opening inwards (*c*): *ovarium* superior, celled, distinct: *ovules* pendulous (*d*): *stigma* sessile (*e*): *fruit* juiceless: *seeds* albuminous.

Geo. position: Europe; meadows and banks of rivers.

Yielding an aromatic oil, and a bitter principle.
Acorus *Calamus.*

TRIBE II. GLUMACEÆ.

ORD. 271. GRAMINACEÆ.—Herbaceous plants, consisting

of cylindrical, fistular, siliceous, and pointed culms, with a fibrous or bulbous rhizome, and alternate leaves with a slit sheath: *flowers* in locustæ*, hermaphrodite, sometimes monœcious, glumaceous (*a*): *glumes*† alternate, unequal (*b*): *paleæ*‡ alternate, the exterior simple: *scales* 2-3, sometimes absent: *stamens* hypogynous: *anthers* versatile (*c*): *ovarium* simple (*d*): *styles* 2: *stigmas* feathery or hairy: *pericarp* membranous: *albumen* farinaceous.

Geo. position: General over the globe, a few confined to the tropics.

Yielding a saccharine matter:
Saccharum *officinarum.* Saccharum *Sinense.*

* Locusta—a short axis bearing alternate imbricate flowers.
† Glume—the exterior floral covering in grasses.
‡ Paleæ—small scales intermixed with the florets in the grasses.

farinaceous matter:

Avena *sativa.* Hordeum *vulgare.*
Triticum *hybernum* Secale *cereale.*

Poisonous—narcotic, acrid:

* Lolium *temulentum.*

fragrant volatile oil:

Andropogon *Calamus-aromaticus.*

CELLULARES.

The second of the great divisions of the Natural System contains very few medicinal plants; but the parasites, which cover many of the medicinal barks, and are characteristic of their qualities, belong to it. There are neither flowers nor sexual organs present in the plants of this division: the reproduction takes place by means of *sporæ* or germs, which are either enclosed in particular cases termed *thecæ*, or embedded in the substance of the plant. The plants of this division have been judiciously divided into three tribes:—*Fern-like, moss-like,* and *leafless,* flowerless plants.

I. FERN-LIKE PLANTS.—FELICALES.

Ord. 280. Polypodiaceæ. — Leafy plants, producing a

rhizome, either subterranean or rising into the air like the trunk of a tree: it is coated by a hard, cellular, fibrous rind, composed of the united bases of leaves: the *leaves* are either simple or variously divided, traversed by dichotomous* cellular veins, with occasional ducts: *stomata* are sometimes observed on the cuticle. The *reproductive organs* consist of *thecæ,* either pedicillate or sessile, appearing on the back or the margin of the leaves, springing either from beneath the cuticle or from the actual surface of the leaves: the *vernation* is circinate.

This term implies that the divisions are always in pairs.

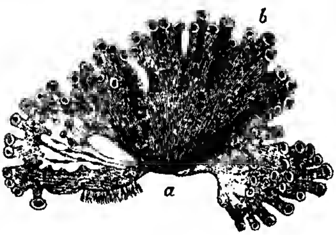
Geo. position : Nearly general over the globe.

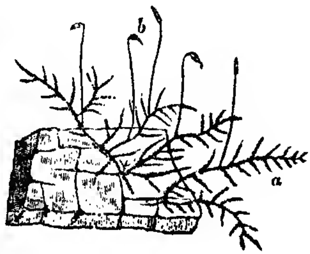
Yielding an acrid purgative principle :
Nephrodium *filix mas.*

Appearing as parasites in the Cinchona barks.
* Hymenophyllum *Tunbridgense.*
* Grammitis *serrulata.*
* Asplenium *pumilum.*

II.—MOSS-LIKE PLANTS—MUSCOIDEÆ.

ORD. 288. MUSCI.—Cellular plants having a distinct axis of





growth, with minute, imbricated, entire, or serrated leaves (*a a*): *Reproductive organs* either axillary, pedicillated, hollow bodies (*b*), containing spherical or oval particles, which are emitted on the application of moisture, or urn-like *thecæ* (*b*), covered by a membranous *calyptra**, closed by an *operculum*†, and filled with sporules attached to an axis.

Geo. position: Wherever the atmosphere is humid; hence abounding in tropical forests.

Appearing as parasites in the Cinchona barks :

* Leucodon *tomentosus.*	* Hypnum *Loxense.*
* Leskea *densa.*	* ———— *Langsdorffii*‡.

HEPATICÆ.—Cellular, terrestrial plants, consisting of an axis or stem, either leafy or bordered by a membranous expansion: the *reproductive organs* are either valved *thecæ*, supported on membranous peduncles, and containing *elateres*§, within which the sporules are intermixed, or they are peltate receptacles, with *thecæ* on the under surface, or sessile naked *thecæ*.

* Calyptra—the interior covering of the ovarium in mosses.

† Operculum—a lid which covers the urn in mosses, and which loosens itself when the sporules are ripe.

‡ This species of Hypnum is found only on semi-putrid, bad, pale bark; but in general the mosses do not indicate a bad quality of the bark.

§ Elateres—elastic, membranous filets fixed to placentæ in the urn of some mosses.

Geo. position: Damp, shaded places in all climates.

Appearing as parasites on bad Cinchona barks.

* Jungermannia *filicina.*

* ——————— *Tamarisci.*

* ——————— *atrata.*

Appearing as parasites on bad Cusparia bark.

* Jungermannia *horizontalis.*

III.—LEAFLESS PLANTS.—APHYLLÆ.

ORD. 294. LICHENACEÆ.—Aërial, leafless, perennial plants, spreading over almost all dry surfaces, whether of trees or stones, which are freely exposed to the light: the body of the plant consists of a cellular and fibrous, lobed and foliaceous, either hard and crustaceous or warty substance, termed a *thallus* (*b*)||: the reproductive organs are either *sporules*, in membranous thecæ (*c*), forming little disks or shields on the surface of the thallus, or separated cellules of the medullary layer of the thallus (*d*): both are termed generally *apothecia*¶.

Geo. position: General over the globe.

Yielding fecula and a bitter principle:

Cetraria *Islandica.*

colouring matter:

Rocella *tinctoria.*

Appearing as parasites on the officinal barks of Cinchona:

Opegrapha *globosa**. O. *ovata**. O. *Bonplandi*‡. O. *nana**. O. *subimmersa**. O. *farinacea*‡. O. *Peruviana*†. O. *rabdotis**. O. *Condaminea**. O. *rugulosa**. O. *scaphella**. O. *rhizocola**.

|| Thallus.—These consist of two parts: one corticular, wholly cellular; the other medullary, cellular, and filamentous.

¶ Apothecia are of various forms, and have different names; for instance, *pelta, scutella, patellula, cephalodium, tuberculum, trica, livella, globules*, &c.

* Characterising good pale bark. † Characterising good yellow bark.

‡ Characterising good red bark.

Graphis *fulgurata**. G. *exilis**. G. *cinerea**. G. *pavoniana**. G. *intricata**. G. *cinnabarina**. G. *hæmatites**. G. *oryzæformis*. G. *frumentaria*‡. G. *chlorocarpa**. G. *rubiginosa**. G. *nivea*‡.

Arthonia *gregaria**. A. *sinensigrapha**. A. *sulfurea**. A. *marginata**. A. *obtrita**. A. *leucocheila**.

Sarcographa *Cinchonarum**.

Fissurina *Dumastii*.

Chiodecton *sphærale**. C. *effusum*†. C. *Meratii*. C. *depressum**.

Trypethelium *variolosum**. T. *verrucolosum**. T. *chiodectonoides*†. T. *clandestinum*†. T. *Sclerotium*†. T. *tetrathalamium**.

Pyrenula *discolor**. P. *umbrata*†. P. *clandestina*†. P. *trypanea*†. P. *annularis*†. P. *pinguis**. P. *verrucarioides**. P. *porinoides*†. P. *mollis*. P. *epapillata*†.

Porina *compuncta*‡. P. *grandulata*†. P. *Americana*†§.

Verrucaria *Acharii*†. V. *sinapisperma*‡. V. *Cinchonæ*†‡. V. *catervaria*†.

Thelotrema *urceolare*‡. T. *lepadinum**. T. *terebratum*†. T. *vverrucosum*†. T. *myriocarpum*‡.

Ascidium *Cinchonarum**†‡.

Lepra *flava**.

Gassicurtia *coccinea*†.

Variolaria *amara*†. V. *communis*†.

Urceolaria *cinchonarum**†‡

Lecidea *aurigera*†. L. *tuberculosa*†. L. *conspersa*‡. L. *duplicata**. L.? *cuticula**. L. *tremelloïdea**.

Lecanora *sorediferа*†. L. *flavo-virens**. L. *subfusca**†. L. *farinacea**. L. *pallidiflava**. L. *Persoonii**. L. *undulata*†.[1]

Parmelia *crenulata**. P. *pulvinata**†‡. P. *alba**†‡. P. *glandulifera**. P. *compacta*†.

Carcinaria *Erythroxyli**.

Sticta *Kunthii*†. S. *Cinchonæ**†‡.

Collema *azureum*. C. *diaphanum*.

Peltigera *vitellina*†.

Borrera *leucomela**. B. *furfuracea**†‡.

Ramalina *Cumanensis**.

Usnea *florida**†‡. U. *barbata**†‡.

Cornicularia *Loxensis**.

Cœnogonium *Linckii**†‡.

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§ On Cascarilla bark.

1 All the Lecanoræ indicate good bark: the following species are general—*S. atra, endochroma, by.siseda, versicolor, sulfureo fusca, russula, puniceа.*

* Characterising good pale bark. † Characterising good yellow bark.

‡ Characterising good red bark.

Appearing as parasites on Cascarilla bark.

Opegrapha *abbreviata.* O. *comma.* O. *calcea.* O. *heterocarpa.* O. *myriocarpa.*
Graphis *tortuosa.* G. *pachnodes.* G. *Cascarillæ.* G. *lineola.* G. *serpentina.* G. *Caribea.* G. *Afzelii.* G.? *endocarpa.*
Arthonia *divergens.* A. *polymorpha.* A. *dilatata.*
Sarcographa *tigina.* S. *Cascarillæ.*
Fissurine *lactea.*
Glyphis *fævulosa.*
Trypethelium *Sprengelii.* T. *crassum.* T. *langeniferum.* T. *scoria.* T. *porossum.*
Parmentaria *astroidea.*
Pyrenula *leucostoma.* P. *endoleuca.* P. *nitida.* P. *pinguis.*
Porina *Americana.*
Veruccaria *epidermidis.* V. *caduca.* V. *Gaudichaldii.* V. *planorbis.* V. *serialis.*
Lecidæ? *Arthonioides.* L. *vernalis.*
Conoicarpa *Cascarillæ.* C. *myriadeum.*
Thelotrema *lepadinum.*
Permelia *perlata,*

Appearing as parasites on Cusparia febrifuga:

Opegrapha *Bonplandi.*[2] O. *inæqualis.* O. *epipasta.*[2] O. *Pelletieri.*[1]
Graphis *leptocarpa.*[2] G. *glaucescens.*[2]. G. *marcescens.*[2] G. *furcata.*[2] G. *rubella.*[2]
Arthonia *complanata.*[2] A.? *torulosa.*[2] A. *fuscescens.*[2] A. *granulosa.*[2] A. *glomerulosa.*[2]
Fissurina *Dumastii.* (var. *α. Bonplandiæ.*)[2]
Glyphis *favulosa.*[1, 2]
Chiodecton *seriale.*[2]
Perynula *umbrata.*[2] P. *Bonplandiæ.*[2] P. *nitida.*[2] P. *fimbriata.*[2] P. *irregularis.*[2]
Porina *marginata*
Verrucaria *stigmatella.*[2] V. *glauca.*[2] V. *Gaudichaldii.*[2] V. *thelena.*[2] V. *decolorata.*[2]
Theolotrema *Bonplandiæ.*[2]
Variolaria *microcephala.*[2]
Myriotrema *olivaceum.*[2] M. *album.*[2]
Urceolaria *viridescens.*[2]
Lecidea *complanata.*[2]

Appearing as parasites on Quassia excelsa.

Opegrapha *Bonplandi.* (var. *α. Quassiæcola.*)
Enterographa *quassiæcola.*
Pyrenula *nitida.*
Porina *Quassiæ.*

[1] On false Cusparia. [2] On true Cusparia.

Verrucaria *epidermidis.* (var. γ *Quassiæcola.*)
Lecidea *carneola.*
Parmelia *minor.*
Thecari *quassiæcola.*
Carcinaria *Berteriana.*
Lecidea *carneola.*

Appearing as parasites on Winter's Bark.

Graphis *Cariboea.*
Pyrenula *nitida.*

ORD. 293. FUNGACEÆ OR FUNGI.—Cellular plants, occa-

sionally mixed with filaments: sometimes stalked (*a*, *b*, *c*), aerial, leafless, with no thallus, nor external sporuliferous disks; frequently ephemeral, the sporules lying loose among the tissue, or enclosed in membranous cases called sporidia (*b*).

Yielding a stimulant principle:
Spermoedia *Clavus.*

Possessing astringent properties:
* Boletus *ignarius.*

Appearing as parasites on bad Cinchona barks.*
Himantia *Cinchonarum.*
Hypochnus *rubrocinctus.*
———— *nigrocinctus.*

ORD. 295. ALGACEÆ.—Leafless, flowerless plants (*a*), without

any distinct axis of vegetation, growing in water: without the

* Fungi indicate that the bark is of a bad quality.

reproductive organs, or with them contained in the joints of the filaments, in *thecæ (b, c, d): sporules* without any proper tegument, germinating by elongating on opposite *directions.*

Yielding a stimulant principle:

Fucus *vesiculosus.*

* Chondrus *crispus.*

* Gigartina *Helminthochorton.*

The localities of the foregoing list of Aphyllous plants are those fixed by M. Fee*, who first pointed out to the practitioner, as well as to the student of Materia Medica, the importance of the study of these parasites in ascertaining the relative value of the different kinds of barks employed as medicinal agents. According to M. Fee, all the specimens of Cinchona bark on which *Hypochnus* is found, are doubtful, and those which afford a locality for the *Himantia*, the *Lycoperdons, Collemata*, and *Jungermannia*, are utterly useless; on the contrary, those may be regarded as good which display on the cuticle the *Graphidæ* or the *Lecanoræ*. The Lichens on the pale Cinchona bark have, for the most part, a thin, white or whitish, rarely yellow, and still more rarely a red or reddish *thallus:* they are chiefly groups of *Graphidæ, Verrucariæ*, and *Parmelaceæ:* those on the yellow Cinchona bark have a *thallus* of a whitish or whitish-yellow hue: they consist chiefly of specimens of *Graphis, Lecanora, Lecidea, Trypethelium, Chiodecton, Pyrenula, Verrucaria*, and *Hypochnus:* and on the red Cinchona bark these parasites are chiefly *Thelotrema, Opegraphæ*, and some unknown lichens which have a peculiar thin white *thallus*, with and without a border. The Cascarilla bark is covered with *Graphidæ*, of elegant and singular formation, the white colour of the *thallus* of which is the chief source of the snowy hue of the exterior coat of the bark: now and then some yellow spots are perceived intermixed with the white, arising from the *thallus* of *Trypethelii;* but these are few, compared with the *Graphidæ*. The true *Cusparia* is covered with Graphidæ, a few *Orpegraphæ*, two *Verrucariæ* and two *Thelotremæ*, a *Glyphis*, a *Chiodecton*, an *Urceolaria*, two *Myriotrema*, and some remains of *Sticta Parmella* and *Jungermanniæ:* on the false Cusparia, on the contrary, there are rarely any parasitic plants, except Opegrapha *Pelletieri;* the tubercular, or, as it has been termed, leprous, character of the epidermis not depending on the presence of *Cryptogamia:* hence the presence or the absence of these parasites affords certain characteristics, in addition to the change of epidermis, for distinguishing the true from the false Cusparia bark†.

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* Essai sur les Cryptogammes des Ecorces exotiques officinales, 4to. *Paris*, 1824.

† The best works connected with the arrangement of Plants according to their natural properties, are the following:—

"Essai sur les Propriétes Médicales des Plants, comparées avec leur formes exte-

SECTION III.

CHEMICAL ELEMENTS OF MEDICINAL AGENTS.

All medicinal agents, whether natural or artificial, consist of simple and compound substances. The simple are few, and chiefly inorganic matters; the compound belong to both the organic and inorganic kingdoms of nature. The compound bodies are either combinations of two simple substances, or they are compounds united with simple bodies or with one another; thus forming series the most extensive, which possess properties perfectly distinct from those of their components. But, although these combinations are varied, yet the elements from which they proceed are few; and the diversity of the substances, whether they be regarded in a chemical point of view, or as therapeutical agents exerting certain influences on the animal œconomy, is more the result of differences in the proportions than in the multiplicity or the number of the elements. From a few elementary matters, indeed, are produced not only the natural substances employed as medicines, but all those also which the pharmaceutical art supplies. These elementary bodies are such as, in the present state of our knowledge, we are unable further to decompose: on which account they are regarded as simple: and, as in noticing the analyses of the various substances of the Materia Medica, frequent reference must be made to them, it is necessary that we should have some general knowledge of their properties.

OXYGEN*.

The most important of the elementary bodies is oxygen—a principle with which we are unacquainted, except in a state of combination. It is the most widely distributed of all the elementary substances, forming a large proportion—21 per cent.—of the volume of the atmosphere; 88·9 hundredth parts of the whole of the water of the globe, and existing as a component of almost every product of the animal, the vegetable, aud the mineral kingdoms. Oxygen is generally described as it exists in

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rieurs et leur Classification Naturelle, par A. P. De Candolle." 2nd edit. *Paris*, 1816.—" Botanique Médicale, par A. Richard," *Paris*, 1823.—" Handbuch der Medicinisch-pharmacentischin Botanik. T. F. L. Nees Von Essenbeck and C. N. Ebermaier." *Dusseldorf*, 3 Th. 1830, 32.

* It was discovered by Dr. Priestly in 1774; and named by him *dephlogisticated air*. Schule, who also discovered it, named it *vital air*. The term Oxygen is derived from the Greek words οξὺς, acid, and γεννάω, I generate. The experience of chemists, since the period of Lavoisier, who imposed this term, has demonstrated its incorrectness; oxygen not being the sole cause of acidity.

oxygen gas*—an invisible, inodorous, insipid, aeriform or gaseous substance, in which the oxygen is supposed to be combined with light, calorie, and electricity—an opinion originating from the fact, that both heat and light are evolved when the oxygen combines with other substances; such, for example, as the metals, or any other combustible, for which it has a great affinity.

In the purest state in which oxygen is known to us, that of oxygen gas, besides the heat and light emitted during combustion, both are extricated when this gas is forcibly compressed. Oxygen gas is colourless, tasteless, inodorous; it is heavier than atmospheric air: when the barometer stands at 30 inches and the thermometer at 60° Fahr. its specific gravity is 1·1026; and 100 cubic inches weigh 34·45 grains. Its atomic volume is 0·5: its chemical equivalent 8. It supports combustion better than air. Ignited charcoal burns in a jar of it with brilliant scintillations; and iron wire, when ignited by a morsel of glowing tinder attached to one extremity, also burns brilliantly in it. It combines with all other elementary bodies. When these are sulphur, phosphorus, or nitrogen, the binary medicinal compounds which it forms are *acids;* when they are metals, *metallic oxides*, the *mineral alkalies*, the medicinal *earths*, and arsenious acid are the result. The ternary and quaternary compounds, into which it enters in many instances, display also acid and alkaline properties; as, for example, the *vegetable acids* and *alkaloids*. In the *fixed* and *volatile oils*, in *alcohol*, *ether*, *saccharine matter*, *gum*, *resins*, *balsams*, *albumen*, *gluten*, *fats*, and almost all organic bodies constituting articles of the Materia Medica, oxygen exists as a component.

Oxygen is essential for the vital existence of all animals and vegetables; hence the name *vital air*. To animals it is requisite for carrying on the function of respiration, whether performed by lungs, or through the medium of the skin: to vegetables, for aiding the faculty of reproduction, and effecting the process of germination; and, in some degree, for the performance of a function, closely resembling that of insect respiration, which the leaves of plants perform in the absence of light. But oxygen, as it exists in pure oxygen gas, rapidly exhausts the excitability of animals, and death quickly supervenes: it is,

* Oxygen gas is usually procured from one or other of the following substances: binoxide of manganese, binoxide of mercury, deutoxide of lead, nitrate of potassa, and chlorate of potassa. The first affords it at the cheapest rate; the last yields the purest gas. If the binoxide of manganese be used, it must be exposed to a red heat in an iron bottle, placed in an open fire, and having a tube communicating with a pneumatic trough containing inverted bottles filled with water for receiving the gas. One pound of good binoxide will yield about 45 pints of gas. If chlorate of potassa, or if the peroxide of Mercury, be used, a green glass retort is sufficient; but it should never be more than half filled with the salt: 124 parts of the Chlorate yield 48 parts of Oxygen gas. A mixture of Binoxide of Manganese and of Chlorate of Potassa yields it readily by the heat of a spirit lamp.

therefore, seldom, if ever, employed in this form as a medicinal agent.

Hydrogen is another element which is very extensively diffused; as it forms one-ninth part of all the water of the globe, and the aqueous vapour in its atmosphere; and is a component of almost every organic product. It is copiously disengaged in several pharmaceutical operations: for instance, during the action of metallic zinc or iron on largely diluted sulphuric acid; in which case water is decomposed; the oxygen, one of the components of that liquid, unites with the zinc, whilst the hydrogen, the other constituent, is set free, and is readily collected in a gaseous state. By employing distilled zinc, the hydrogen gas is obtained pure.

Pure hydrogen gas is invisible, inodorous, and insipid, and the lightest body in nature. Its specific gravity is only 0·0688, or 14·4 times lighter than air; and the weight of 100 cubic inches, referring to the composition of water†, is assumed to be 2·15 grains, at a barometrical pressure of 30 inches, and 60° Fahr. or sixteen times lighter than oxygen gas. 100 cubic inches of water dissolve only $1\frac{1}{3}$ cubic inch, or one 75th of its volume of this gas. It is probable that, like oxygen gas, it is a compound; but this cannot be ascertained. It has never been decomposed, nor condensed to the liquid state. It does not support combustion; but it is highly inflammable whenever it comes in contact with oxygen at an elevated temperature: if mixed with it or even with common air, and fired, a violent explosion takes place; if not mixed, the combustion is slow, and only at the point of contact of the gas and the air: in both cases, caloric and light are evolved, and water is formed. The atomic weight or chemical equivalent of hydrogen is 1, and its atomic volume is also *one*.

Hydrogen exists as an element of many medicinal agents: namely, *water*, which has been already noticed, *ammonia, hydrochloric, hydrocyanic,* and *hydriodic acids*, which are binary compounds: the ternary are *alcohol, sulphuric ether*, all the *vegetable acids* employed as medicines, *piperina, salicina, elatina, wax*, the *fixed oils, camphor, fecula, gum, sugar, resins, balsams,* and *vegetable gluten*:—the quaternary are *nitric ether, the volatile oils, hydriodates of oxides of Iron, of Arsenic,* the medicinal *hydro-*

* This name, which was imposed by Lavoisier, is derived from the Greek words ὕδρω, water, and γεννάω, I generate. Its properties and nature were first investigated by Mr. Cavendish, 1776.

† According to Berzelius and Dulong, 100 parts of pure water are composed of 88·9 of oxygen and 11·1 of hydrogen, or as near as possible in the proportion of 8 to 1; but eight parts of oxygen by weight occupy only one half the space of one part of hydrogen; hence it is evident that oxygen is sixteen times heavier than hydrogen.

sulphurets, oil of wine, emetia, the *vegetable alkaloids, bitumens, animal gelatin,* and *fats.* In some of the chemical changes, also, which occur through the agency of water in pharmaceutical operations, and which depend as much on the nature of its elements as of its affinity, hydrogen plays a conspicuous part.

Hydrogen gas cannot alone support the respiration of animals, who, therefore, die when they are immersed in it: but it is doubtful whether this arise solely from the absence of oxygen gas, or whether the hydrogen exerts a sedative influence on the nervous system. An atmosphere composed of hydrogen and atmospheric air or oxygen gas, in due proportion, supports respiration; but we are still unacquainted with the effects which this gas produces on the animal œconomy.

NITROGEN*

Is another elementary substance which is known only in a state of combination. It forms upwards of 79 in every 100 parts of atmospheric air, and is readily procured by whatever abstracts oxygen from common air. The simplest mode of effecting this is to burn phosphorus in a jar filled with air and inverted over water. The phosphorus, by combining with the oxygen, is converted into an acid, the phosphoric, which is absorbed by the water; the residual gas consists of nitrogen, a minute portion of carbonic acid, and a little vapour of phosphorus in solution; but, after being agitated with a solution of potassa, or of lime water, nothing but pure nitrogen gas remains.

Nitrogen, as obtained in the gaseous form, is invisible, insipid, and inodorous; it is distinguished from oxygen by not supporting combustion, and from hydrogen by not being inflammable. It is lighter than atmospheric air, its specific gravity being 09760: 100 cubic inches, at the barometrical pressure of 30 inches, and 60° Fahr. weigh 30·15 grains. Sir H. Davey and Berzelius have maintained that nitrogen is a compound; but their opinions are purely hypothetical. 100 cubic inches of water absorb only one cubic inch and a half of nitrogen gas. The chemical equivalent of Nitrogen is 14·15. When combined with oxygen, by means of the electric spark, it forms Nitric acid.

The medicinal compounds in which nitrogen is a component are not numerous: the binary are *nitrous* and *nitric acids* and *ammonia;* the ternary are the *cyanides of mercury;* the quaternary, *hydrocyanic acid,* some *volatile oils,* the *vegetable alkaloids,* all the *animal products,* and the *nitrates.*

* This name has originated from the fact that Nitrogen is the generator of Nitre, from νίτρον, *nitre,* and γεννάω, *I generate.* It was called *Azote,* from the Greek primitive α, and ζωή, life. It was first recognized by Professor Rutherford of Edinburgh, in 1772.

Nitrogen gas is fatal to animal life; but only from the absence of oxygen, as it exerts no injurious influence on the living system; a fact which instantly presents itself to the mind, when we reflect that it is the diluting medium of oxygen in atmospheric air.

CARBON.

The Diamond is supposed to be Carbon in a state of absolute purity; the term Carbon, however, is usually employed to signify the inflammable base of Charcoal, which is the residue of all animal and vegetable, and many mineral, substances, when they are heated to redness in close vessels.

Pure Carbon, the Diamond, is prepared by the hand of Nature, crystallized in octohedrons: it is intensely hard, and refracts light powerfully; a circumstance which suggested to Newton its combustible nature. When submitted to a high temperature in oxygen gas, or with substances which freely yield oxygen, it is entirely consumed, and carbonic acid is generated. The specific gravity of the Diamond, or of pure Carbon, is 3·520. The chemical equivalent of Carbon is 6·12; but Carbon, in the state of combination, forms the basis of almost all organic bodies. It is also an element of many medicinal agents. The binary compounds are few:—only *charcoal*, *carbonic acid*, and pure *oil of turpentine**: the ternary are *hydrocyanic acid*, the *cyanurets of mercury*, all the *vegetable acids* employed in medicine, *alcohol*, *ether*, *gum*, *fecula*, *sugar*, *manna*, *resins*, *wax*, *elatin*, *piperina*, *salicina*, *fixed oils*, *camphor*: the quaternary are salts composed of the oxides of a metal and carbonic acid, the *alkaline carbonates*, those of *baryta*, *lime*, *magnesia*, *iron*, and *lead*: the *vegetable alkaloids*, *oil of bitter almonds*, the medicinal *volatile oils*, and some animal products.

For many pharmaceutical purposes, pure Charcoal, both of a vegetable and an animal origin, is required.

Vegetable Charcoal is procured for ordinary use by forming billets of wood into piles, which are covered over with earth and sods; and which being ignited, with a regulated access of air, the water and other volatile matters are dissipated, and solid Charcoal remains. But for pharmaceutical use it undergoes a second process: firm pieces of common Charcoal are selected, and, being put into a crucible, and covered with clean sand, they are exposed for some time to a red heat. Thus prepared, Charcoal is a black, inodorous, insipid, brittle substance, permanent in the air; but, nevertheless, it should be kept in close vessels, as it rapidly absorbs both air and fluids. For particular purposes, it may be procured tolerably pure by subjecting

* Gay Lussac and Houton Labillardiere.—Journ. de Pharm. vol. iv.

starch to a red heat in close vessels. Common Charcoal contains a small proportion of alkaline and earthy salts; but it is free from these when obtained from the vapour of alcohol passed through a red-hot tube.

Animal Charcoal.—Ivory-black is a mixture of Charcoal and Phosphate of Lime: by digesting it in diluted hydrochloric acid, and then washing and drying it, the earthy salt is removed, and pure animal Charcoal remains.

Pure Charcoal is insoluble in water, and is little affected by any of the acids, except the nitric, or by any of the alkalies. Besides gases and liquids, it absorbs both *odours* and *colouring* principles from animal and vegetable matters: hence the general employment of it, particularly animal Charcoal, for decolouring vegetable solutions.

CHLORINE.

Chlorine is obtained by decomposing hydrochloric acid, which is a compound of this elementary substance and hydrogen, by means of binoxide of manganese*: or it may be procured by mixing together three parts of common salt, with one part of the binoxide of manganese; and pouring over them two parts of sulphuric acid diluted with an equal weight of water; exposed to the action of a gentle heat. It is known only in its compound state, or a gas, which, besides the Chlorine, contains caloric and light; both of these substances being emitted when this gas is strongly and suddenly compressed.

Chlorine gas has a greenish-yellow colour†, an astringent taste, and a peculiar, pungent, suffocating odour; its specific gravity is 2·47: 100 cubic inches, at the ordinary barometrical pressure and at a temperature of 60°, weigh 76·25 grains. Under a pressure of four atmospheres, in a temperature of 60° Faht., it assumes the form of a transparent yellow liquid. Water at 60° absorbs nearly twice its bulk of Chlorine gas, and the liquid acquires the colour, taste, and odour of the gas; it is again disengaged when this solution is heated; and when it is kept exposed to light, a portion of the water is decomposed, and, the hydrogen uniting with the Chlorine, hydrochloric acid is formed.

Chlorine destroys the colour of all vegetable matters in a moist state or in solution; but perfectly dry Chlorine gas does

* The best proportions of the above material for preparing Chlorine gas are one part of binoxide of manganese in fine powder, and two parts of strong hydrochloric acid. These ingredients may be put into a tubulated retort, large enough to hold double the quantity, and having passed the beak into a pneumatic trough, containing warm water, and applying a moderate heat to the retort, the gas may be received in wide-mouthed glass bottles containing warm water. As soon as each bottle is filled, it should be immediately closed, under water, with a ground stopper, first drawing the finger round the edge with a small quantity of a lute composed of one part of wax and three of lard.

† The appellation Chlorine is derived from the Greek word χγωρος, green.

not affect dry vegetable colours. It is a supporter of combustion, for a lighted taper burns in it, with a dull red flame, giving off much smoke; and phosphorus, tin, copper, arsenic, antimony and zinc, when pulverized or in thin foil, spontaneously takes fire, when introduced into Chlorine gas, and combine with it: its range of affinity, indeed, is most extensive. The chemical equivalent of Chlorine is 35·42.

The medicinal agents of which chlorine forms a component are numerous. The binary compounds are *hydrochloric acid*, the *chlorides of sodium, barium, calcium, mercury*. The Chlorine, according to its quantity, forms *proto-chlorides, deuto* or *bichlorides*, and *perchlorides*. The quaternary are compounds of chloric acid with oxides;—*chlorate of potassa* and of *soda;* the senary compounds are the compounds *of hydrochloric acid* with oxides; *hydrochlorate of iron, hydrochlorate of ammonia, hydrochlorate of magnesia, of morphia, strychnia, cinchonia, quina*, which are crystallizable salts.

Chlorine has a powerful influence on the animal œconomy, as shall be noticed in its proper place. It possesses, also, antiseptic properties.

BROMINE.

When Chlorine is passed into a solution of *Bittern*, the mother liquor remaining after the crystallization of Chloride of Sodium from sea water, a deep yellow colour is developed, and by distillation passing the vapour over Chloride of Calcium, a deep orange-red fluid is obtained, which is Bromine. It was discovered by M. Barard, of Montpelier, in 1826.

Bromine is a fluid of a deep orange-red colour, but hyacinth-red when viewed by transmitted light. It exhales a strong, disagreeable odour*; and has a powerful, nauseous taste. At a temperature below 0° Faht. it congeals and becomes brittle. Its sp. gr. is 3. It is extremely volatile, and boils at 116·5. It does not support combustion. It is soluble in water, alcohol, and ether; the latter abstracts it from all other fluids. It bleaches vegetable colours.

The chemical equivalent of Bromine is 78·4.

The only medicinal agent, in the British Pharmacopœias, in which Bromine is a component, is a binary compound—*Bromide of Potassium;* but the Bromides of *Iron* and *Zinc* are sometimes employed. Bromine acts as a powerful excitant to the animal economy.

IODINE†.

This elementary substance was not known till 1812, when it

* The name originated from this property being derived from βρωμος, *Graveolentia*, a rank odour.

† The term Iodine is derived from the Greek word ἰωδης, violet-coloured.

was discovered by M. Courtois in preparing carbonate of soda from *kelp*, the ashes of Fuci, and other marine plants. He observed that the residual or mother liquor corroded metallic vessels; and, in experimenting to ascertain the cause of that corrosion, he found that a mixture of manganese and sulphuric acid precipitated from the residual liquor a dark-coloured metallic-like matter, which the application of heat converted into a beautiful violet vapour*. Iodine is usually prepared by adding diluted sulphuric acid in excess to the above-mentioned residual liquor, then boiling, and afterwards leaving the whole at rest for some time, and filtering. Binoxide of manganese, in the proportion of 1000 grains for every twelve fluid ounces of the liquor, is added to the filtered fluid, which is now a solution of hydriodic and sulphuric acids. The mutual reaction of the binoxide and the acid decomposes the whole of the hydriodic acid, the hydrogen of which combines with the oxygen of the peroxide and forms water; whilst the Iodine, thus set free, is sublimed, by the application of a moderate heat, into a cool receiver, and sulphate of manganese remains. The Iodine is afterwards purified by mixing it in water containing five parts of potassa, and re-subliming.

Iodine is an opaque, soft, friable, bluish-black, scaly, crystalline substance, in brilliant scales or plates, with a metallic lustre, it has an acrid hot taste, and the odour of chlorine, but is less pungent; staining temporarily the fingers brownish-yellow, and having a specific gravity of 4·948. It is a non-conductor of electricity, and a negative electric: 100 cubic inches of its vapour weigh 264·75 grains. It is soluble in alcohol and ether. At a heat much under 212°, it sublimes; at 225½° it fuses, and boils at 347°: it is distinguished from all other substances by the rich violet colour of its vapour, and by its property of uniting with starch and forming a compound of a deep blue colour. This test detects the presence of Iodine in a liquid containing one 450·000th of its weight. It requires for solution 7000 parts of water, to which it communicates a brownish tint: alcohol and ether dissolve it readily, forming deep reddish-brown solutions. It possesses bleaching powers.

The chemical equivalent of Iodine is 126·3: its range of affinities is very extensive.

The medicinal agents in which Iodine exists as a component are very few, the binary compounds are *Iodides of Potassium, of Arsenic, Iron, Lead, Mercury, Zinc*, and *Sulphur*; there is one quaternary only, *Tincture of Iodine.*

Iodine acts as a powerful stimulant on the animal economy: its physiological action and therapeutical influence shall be noticed in their proper place.

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* For Courtois' Experiments, see Ann. de Chimie, tome 89, 90, 91; and for those of Sir H. Davy, Phil. Trans. 1814-15.

SULPHUR.

Sulphur is a non-metallic element, found ready formed as a mineral production in the neighbourhood of volcanos, generally more or less crystallized in the form of an oblique octohedron. In this state it forms native or virgin sulphur; but it is, also, found in combination with other substances, especially metals. It is abundantly procured by exposing iron or copper pyrites* to a red heat in close vessels. It is also a component of many organized bodies, both animal and vegetable†. In order to purify native Sulphur, it is formed into heaps, which are set fire to, and the heat of one portion fuses another. It is imported in blocks or oblong masses. It is sometimes procured by precipitating it from fluid Sulphurets by means of hydrochloric acid, in which case it is a *hydrate of Sulphur.*

Pure Sulphur is nearly insipid, odorous only when it is rubbed or melted, and of a bright greenish-yellow colour: it is a non-conductor of electricity. Its specific gravity is 1·98: when it is melted, and the temperature raised to 450° Fahr. on throwing it into the water, the gravity is augmented to 2·325. Sulphur softens at 105°; begins to evaporate at 170°; and completely evaporates; it melts at 220°; it begins to thicken again at 320°; solidifies at 350°; and becomes extremely viscid before it attains its second melting point, which is 482°; it boils at 600°, and condenses unchanged; but at 300° in the open air, it takes fire. It is insoluble in water; but its vapour is soluble in vapour of alcohol: Sulphur itself dissolves also in ether, and in boiling oil of turpentine. The chemical equivalent of Sulphur is 16·1.

Sulphur is a component of a small number only of medicinal substances; the binary compounds are, with oxygen, *sulphuric acid;* with hydrogen, *Hydrosulphuric acid.* It combines with the metals, forming *sulphurets of potassium, calcium, antimony,* and *mercury,* and *iodide of sulphur.* Except *hydrate of sulphur,* there are none of its ternary compounds used as medicines: the quaternary are the *sulphates* of the *mineral alkalies,* of *magnesia, alumina, potassa, iron, copper, zinc, subsulphate of mercury:* the quinary is *sulphuretted oil.*

The influence of Sulphur on the animal œconomy shall be noticed in its proper place.

* The yellow iron pyrites, bisulphuret of iron, yields the greatest quantity of sulphur. There are fourteen metallic sulphurets.

† Sulphur is found in the Cruciferous plants, particularly in the seeds of Mustard and those of Celery; in Garlic and other Liliaceæ; in the Aurantiaceæ, as, for instance, the flowers of the Orange; in the farina of Rice, the proper juice of Ferula *Assafœtida*, and some other Umbelliferous plants; in the rhizomes of Alpinia *galanga;* and in the roots of Rumex *patientia.* It is also a constituent of eggs, horns, hoofs, hair, urine, and some other animal substances.

This element is very abundant in the animal kingdom; it is procured by the decomposition of the phosphate of lime in bones, in which it is combined with oxygen, forming phosphoric acid. The bones are burned, and to the ashes made into pap with water is added dilute sulphuric acid, which takes up a portion of the lime of the bones, forming it into gypsum, sulphate of lime; and leaves the freed phosphoric acid with the remainder, in the form of a biphosphate. The phosphoric acid in this salt is then decomposed by means of Charcoal, and the phosphorus distilled over into water contained in a copper receiver. During the process, carbonic acid gas, and carbonic oxide gas, are evolved; and phosphate of lime with charcoal form the residue of the distillation. Phosphorus thus obtained has a flesh-red colour; but when it is fused under a warm solution of ammonia, and again under alcohol, it is procured pure.

Phosphorus, when pure, is nearly transparent and almost colourless, of the consistence of wax, and easily cut with a knife. Its specific gravity, at the usual barometrical pressure and temperature, is 1·77. At the temperature of 32° it is brittle; at 60°, in common air, it undergoes a slow combustion, although in oxygen gas the temperature for this purpose must be 80°; at 108°, in the air, it inflames; in oxygen gas the combustion is rapid and brilliant, and phosphoric acid is formed: in close vessels it fuses at 100°, under water it melts at 105°, and boils at 550°, rising in vapour. In the atmosphere, whilst it undergoes a slow combustion, it emits light, and exhales the odour of garlic.

Phosphorus is tasteless and insoluble in water†; but it readily dissolves in hot alcohol, ether, naphtha, and fixed and volatile oils. The chemical equivalent of Phosphorus is 15·7‡.

The only medicinal substance which contains it as a binary compound is *phosphoric acid*: the quaternary compounds are *phosphate of soda* and *phosphate of lime*.

Phosphorus exerts a powerfully stimulant influence on the animal economy: its effects will be noticed in their proper place.

BORON§.

Boron is not extensively found in nature, and never in an uncombined state. It is a dark olive-brown substance, procured

* Phosphorus was discovered in 1669, by Brandt, an alchemist of Hamburgh, who procured it from urine. Its name is derived from φως, light, and φερω, I bring.

† On this account, and to prevent the slow combustion which it undergoes in the air, it should be kept under water, and in an opaque or blackened bottle.

‡ Berzelius.

§ Boron was discovered by Sir H. Davy, in 1807, by exposing Boracic acid to the

by abstracting the oxygen from one part of boracic acid, which has been previously fused and pulverized, by means of two parts of potassium, at a high temperature. When these two substances are heated together in a copper tube, at 300° Faht. the mass suddenly becomes red hot: and when the product has been washed with hot water, the residue is Boron. It is insipid and inodorous, a non-conductor of electricity, and unalterable in the air at ordinary temperatures; but when heated to 600° Faht. in the air, it burns brilliantly, combines with the oxygen of the air, and is converted into Boracic acid, which is also generated when Boron is heated with sulphuric or nitric acid, or with nitrate or chlorate of potassa. The sp. gr. of Boron is 2. It bears an intense heat in close vessels, without being changed, except in its density and hardness, both of which are augmented. It is insoluble in water, but soluble in alcohol. The chemical equivalent of this element is 20·2.

The only medicinal substances in which Boron exists as a component, are one binary compound, *Boracic acid;* and one quaternary, *Biborate of soda.*

METALLIC ELEMENTS.

The description of elementary bodies which come under the denomination of metals, possess certain properties that characterize them. With the exception of mercury, they all become hard or solid at ordinary degrees of heat. They are fusible and even volatilizable at certain elevated temperatures. They possess *lustre*, pervading every part; *opacity*, even when they are reduced to extreme thinness. They differ in *weight—potassium* and *sodium* being lighter than water, *platinum* more than twenty-one times heavier than water. They possess *tenacity*, or the power of resisting the influences which tend, mechanically, to separate their particles from one another. Some of them possess, also, *malleability*, or the property of being expanded under the hammer. Gold is the most malleable of the metals. Their *ductility*, or the capacity of being drawn out into wire, is also great. They differ from one another in the degree in which they possess these properties. All of them are conductors of electricity. The greatest number of metals are insipid and inodorous; but a few, copper, iron, and tin, acquire both odour and taste when rubbed or heated. They differ in colour: silver, tin, lead, iron, have a whitish or grey-blue tinge; bismuth is reddish; gold is yellow, and copper red. Some of them are always found in a

influence of a powerful galvanic battery. It may be procured, as above mentioned, by heating Boracic acid with potassium. In the process, the oxygen of a portion of the acid, which is decomposed, oxidizes the potassium, forming it into potassa, which combines with the undecomposed Boracic acid, as a Borate, whilst the Boron is set free.

state of combination; others frequently, as gold, silver, copper, bismuth and mercury, in a pure state. They form saline bases with oxygen, with the exception of gold: thus the alkalies, *Potassa* and *Soda;* the alkaline earths, *Baryta, Lime, Magnesia, Alumina,* are oxides of metals. I shall arrange the metals—1, as they are found always in *combination;* 2, as they occasionally occur native in a *pure* state.

a. Metallic Elements which are found only in a state of Combination.

POTASSIUM.

Although the oxide of Potassium, *Potassa*, has been known from a very early period, yet its metallic or elementary base was unknown until 1807, when it was discovered by Sir Humphrey Davy. It is procured by decomposing carbonate of Potassa, by means of charcoal, according to a process suggested by M. Brunner*, and afterwards modified by Wöhler. But the carbonate of Potassa must be used directly it is formed from calcining Bitartrate of Potassa in a red heat until all the gas is disengaged, and reducing the residue to powder the moment it cools. After the Potassium is procured, it should be redistilled into a receiver containing pure Naphtha.

It is, also, procured in the following manner. Some Potassa is fused and made to pass over clean iron turnings heated to whiteness in a gun barrel. The hydrogen of the water contained in the Potassa, and decomposed by the hot iron filings, reacts upon the Potassa, abstracts its oxygen, and sets free the metal, the Potassium; which distils over into a small copper receiver. It requires to be preserved in Naphtha; that substance containing no oxygen.

Potassium is an opaque, crystalline metal, resembling steel or lead in colour and lustre; its specific gravity is 0·865, at 60° Faht. and under the ordinary barometrical pressure. It is a good conductor of electricity. At the temperature of 32° Potassium is brittle, at 50° it is soft, and malleable, at 60° it becomes soft like wax, at 70° acquires a degree of fluidity, and at 136° is perfectly fluid. Its chief characteristic is its powerful affinity for oxygen; by which means its lustre is dulled, instantly, when it is cut in the air; and it cannot be preserved except under naphtha. From the same cause, it rapidly decomposes water: much heat and light is extricated, hydrogen gas is evolved, and the metal, being oxidized, is converted into potassa. This is rendered evident by burning Potassium on water coloured with an infusion of red cabbage, which is turned green as the alkali

* Quarterly Journal of Science, vol. xv and xxii.

forms. When heated in the air, it first fuses, and then burns with a rose-coloured flame; and is converted into a peroxide.

The binary medicinal compounds in which this element exists are *potassa;* the *sulphuret* and *bisulphuret of Potassium;* the *Iodide*, the *bromide*, the *chloride of Potassium:* the quaternary are salts composed of *acids* and the *oxide* or *potassa.* The chemical equivalent of Potassium is 39·15.

Potassium is not employed in its uncombined state as a remedial agent.

SODIUM.

This elementary substance was also discovered by Sir Humphrey Davy, nearly about the same time that he discovered potassium. It may be prepared by decomposing, with the aid of heat, the chloride of Sodium by means of potassium: the latter is converted into a chloride, and the Sodium procured in its pure state. It may also be obtained by decomposing carbonate of soda by means of charcoal.

Sodium resembles silver in its colour and lustre: its specific gravity is 0·972. At the ordinary temperature of the air it is soft, and may be moulded like wax: it fuses at 194°—200°, and is volatilized in a full red heat. It has a powerful affinity for oxygen, which it attracts rapidly from the air; and, like potassium, it is also oxidized when placed upon the surface of water; but the decomposition of the liquid is less rapid, and no light is visible, unless the water be hot, when a few scintillations appear. In both instances soda is generated; but, when Sodium is burnt in pure oxygen gas, it evolves a yellow flame; and a peroxide of an orange colour is formed. The chemical equivalent of Sodium is 23·3.

The medicinal binary compounds of Sodium are *soda*, the *chloride*, the *iodide*, and the *bromide of Sodium:* there are no ternary compounds: and the quaternary and quinary, like those of potassium, are salts composed of acids and the *oxide* or *soda.*

Sodium is not employed in medicine in its uncombined state.

BARIUM*.

This metal was also discovered, in 1808, by Sir H. Davy. It is procured by decomposing the Carbonate of Baryta. He formed the Carbonate into a paste with water, placed it on a platinum tray, and laid a globule of mercury in a little hollow on the surface of the paste; the positive pole of a powerful galvanic battery was then brought into contact with the tray, and

* From βαρυς, heavy.

the negative pole with the mercury. The oxygen of the Baryta was thus disengaged from the Barium, which amalgamated with the mercury; and, by afterwards distilling this amalgam, so as to drive off the mercury, the Barium was obtained in its metallic state.

Barium is of a dark grey colour, with little lustre, and considerably heavier than water; and even sinking in sulphuric acid. It is rapidly oxidized in the air, when heated, and burns with a red flame; and also by decomposing water when it is thrown into that liquid: in both cases Baryta is produced. It fuses at a red heat. The chemical equivalent of Barium is 68·7.

The only binary medicinal compounds of this element are the *chloride of Barium* and the *protoxide* or *Baryta;* the former is the only salt of Barium medicinally used.

CALCIUM.

Calcium was first procured by Sir H. Davy, by a process similar to that by which he obtained Barium. From the minuteness of the quantity in which it has hitherto been procured, its properties are little known, except that by exposure to the air it is oxidized and converted into Lime. The chemical equivalent of Calcium is 20·5.

The binary medicinal compounds of Calcium are the *Chloride of Calcium* and the *Protoxide* or *Lime;* the Chloride is a binary compound; the only ternary compound is the *Hydrate*, or slacked Lime; the *Carbonate* is a quaternary compound salt of Lime with an acid base.

MAGNESIUM.

This metal was also discovered by Sir H. Davy, who procured it by the same process as he adopted for Barium. In 1830, M. Bussy found that if Chloride of Magnesium be mixed with Potassium, and the mixture be subjected to a red heat in a porcelain tube, the chlorine quits the Magnesium and is taken up by the potassium :, on washing out the chloride of potassium, the Magnesium, set free, is obtained in the form of minute brown scales, which leave a metallic trace resembling lead or silver when they are rubbed in a porcelain mortar. At a high temperature, Magnesium attracts oxygen and is converted into magnesia.

There are only two binary medicinal compounds of Magnesium, namely, the *oxide* or *magnesia* and the *chloride;* the saline compounds, the *carbonate*, the *sulphate*, the *acetate*, and the *citrate*, are salts of the oxide. The chemical equivalent of Magnesium is 12·7.

Magnesium is not used in its uncombined state in medicine.

ALUMINIUM.

This elementary, metallic base was procured, in a pure state, by Wöhler, in 1828, from the decomposition of chloride of aluminium by potassium, in the form of a grey powder, or rather in small scales, of a colour and lustre resembling tin. It is insipid, inodorous, nearly insoluble in water, requires a very high temperature for fusion: in its fused state it is a conductor of electricity. It takes fire at a red heat in the open air, burns with a vivid light, and is converted into alumina: in pure oxygen gas the combustion is brilliant, and the emission of heat intense: it is also very feebly oxidized in water, which it decomposes, but only at the boiling point; and, also, in solutions of Potassa and Soda, at 60°. Its action on water is greatly aided by dilute sulphuric and hydrochloric acids, and solutions of potassa and of ammonia. The chemical equivalent of Aluminium is 13·7.

There is no medicinal compound in which Aluminium is an immediate component, except *Alumina*. In alum, the oxide, *alumina*, is united with sulphuric acid.

ZINC.

Zinc is procured from its native sulphuret, *Blende*, or from its oxide, *Red Zinc*, or its native carbonate, *Calamine*, of which there are several varieties. In reducing the ores, which are first roasted, they are put into a covered crucible, with a tube fixed in its bottom, the Zinc, when separated, is volatilized, driven through the tube, and condensed in a separate vessel containing water: or the oxide is mixed with charcoal and reduced. It is purified by another distillation into a receiver containing water.

Zinc has a bluish-white colour, a strong lustre, of a lamellar and crystalline texture. Its specific gravity is 7·2. It is acted on by the file with difficulty: it is malleable and ductile at temperatures between 212° and 300°; but, at a low or a high degree of heat, it is brittle. It fuses at 773° Faht.; and, on slowly cooling, it crystallizes in hexagonal prisms. At the ordinary temperature of the air, it scarcely attracts oxygen; but at a high temperature, it rapidly combines with oxygen; and, at full redness, it burns with a vivid, white flame, and forms the white oxide. It is also oxidized, and is then soluble in dilute sulphuric acid, leaving a scanty greyish-black residue. The chemical equivalent of Zinc is 32·3.

The *oxide*, the *chloride*, and the iodide are the binary compounds of Zinc medicinally employed: there are no ternary

compounds: in the quaternary, the Zinc is indirectly as an oxide combined with acids. Metallic Zinc exerts no action on the animal system.

b. Metallic Elements which are occasionally found in a Pure State.

IRON.

Iron is the most abundant of metals, being found in one form or another in almost every part of the world. It is rarely procured in the metallic state, *native Iron;* but very abundantly in combination with sulphur, as *Iron pyrites;* with oxygen, as *hæmatite;* and sometimes with saline bodies: it also forms a component of many plants; and there is much reason for believing that it exists as an oxide in animal blood. For the purposes of medicine and of commerce, metallic iron is procured chiefly from common *clay ironstone* (*Mine*), *red hæmatite, brown hæmatite,* and *black magnetic iron ore.* The first yields about thirty-five per cent. of iron; the others about seventy per cent. In all, the iron exists in combination with oxygen as a peroxide.

Iron is extracted from these and other ores by reducing them to coarse powder, mixing this with charcoal and lime, and exposing the whole to an intense heat in a furnace. In this process, the charcoal takes the oxygen from the iron, which is fused and falls to the bottom of the furnace; it is there protected from the action of the air by the fusible *slag* which is formed by the carbonaceous flux combining with the impurities of the ore. The fused iron is let off by a hole in the bottom of the furnace; but it is not pure, and contains oxygen, carbon, silicon, and sometimes sulphur; to free it from these and any unreduced ore, it is again exposed to a strong heat with a current of air playing upon its surface, which reduces the undecomposed ore, whilst the carbonaceous matter is burned. The solid Iron thus obtained is afterwards hammered and rolled, to increase its tenacity and render it malleable iron.

Native Iron is rare. A specimen, about four pounds in weight, was found in the mine of Hackenberg; and another in the mine of Johanner, near Kamsdorf, in Saxony. Those singular metallic masses, called aerolites, that have fallen from the atmosphere in various parts of the world, are nearly pure Iron, with a small admixture of another metal, *nickel,* which distinguishes aerolites from true native Iron.

Pure Iron is a hard, ductile, malleable, and very tenacious metal, of a peculiar, grey colour, susceptible of a high polish. It impresses a styptic taste. In its purest state, it is scarcely

fusible*, and has never been volatilized; but when heated to redness, it softens. The specific gravity, at 60° under an ordinary barometrical pressure, is 7·788. It is attracted by the magnet, and may itself be readily rendered magnetic. It has a strong affinity for oxygen, and attracts it from the air when moisture is present: it also decomposes watery vapours, at all temperatures, forming *rust*, which is a hydrated-sesquioxide of Iron. When heated to redness in the air, it is rapidly oxidized; and in oxygen gas it burns with vivid scintillations. The chemical equivalent of iron is 28.

Iron is present in several medicinal substances and preparations. The binary compounds containing it as a direct component are the *sulphuret* and the *bisulphuret*, the *Iodide*, the *Bromide*, the *Sesquichloride*, and the *oxides*: in the salts, the *carbonate*, *sulphate*, and *potassa-tartrate*, and in the preparation termed *Ammonio-chloride*, it exists only as an indirect component.

Iron, both in its pure and its combined state, is medicinally employed; but it exerts no physiological action on the animal œconomy in its metallic state, unless it meet with acid in the stomach.†

ARSENIC‡.

Arsenic is found native; but commonly in combination or alloyed with iron, copper, cobalt, silver, or gold, or united with sulphur, in the shape of arsenical pyrites, or that of Orpiment or realgar. The former occurs in Sicily, Italy, Hungary, and Germany; the latter chiefly in Hungary, and in Turkey in Asia. A native oxide is also found in Germany; but it is rare.

Arsenic, in its metallic state, is found in different parts of Germany, in masses more or less considerable, having, when the masses are fresh broken, a brilliancy and a lustre equal to that of silver; but quickly becoming tarnished when exposed to the air.

Metallic Arsenic may be obtained by calcining any of the ores, in conjunction with charcoal: it is also produced by decomposing the white oxide or arsenious acid, by means of twice its weight of the black flux§; the metallic Arsenic is sublimed when the crucible containing the mixture acquires a red heat, and is condensed in an empty crucible inverted above the former and kept cool‖.

* Cast iron fuses at 2786.

† It was employed as a medicinal agent more than 1358 years before the Christian era.

‡ Name derived from αρσενικος, strong.

§ Black flux—a compound of two parts of crude tartar and one part of nitre deflagrated together.

‖ In a large way, the distillation is performed in earthen retorts coated with a

Arsenic is a brittle metal, of a bluish white or steel-grey colour, brilliant, inodorous, and insipid; its structure is crystalline; its specific gravity 5·8843: when suddenly exposed to a white heat, it inflames and burns with a bluish white flame; but when the heat is not more than 356°, it rises in vapour, is oxidized, and emits a strong odour of garlic, which distinguishes it from all other metals. This odour is perceived only at the commencement of the oxidizement of the metal, which cannot be volatilized in the open air without undergoing oxidation. This volatility prevents Arsenic from fusing, except under a very high pressure. It attracts oxygen from the air at 60°, losing its lustre and falling into a black powder, which is supposed to be a suboxide; and it is also slowly oxidized and dissolved when it is boiled in water. It burns in dry chlorine and is converted into a sesquichloride. It unites with oxygen in two definite proportions. It also combines with hydrogen, forming *arseniuretted hydrogen.* The chemical equivalent of Arsenic is 37·7.

The only medicinal agents in which Arsenic exists as an element is *Arsenious acid*, *Sulphuret of Arsenic*, and *Iodide of Arsenic*, which are binary compounds.

Metallic Arsenic exerts no influence on the living animal system.

ANTIMONY.

Antimony is found native at Sala in Sweden, and in the Hartz mountains. It also occurs in combination with oxygen, and mixed with other metals: but the most abundant of its ores is the sulphuret, from which the metallic Antimony of commerce is derived. For procuring metallic Antimony, the native sulphuret is decomposed by heating it in covered crucibles with half its weight of iron filings: the sulphur combines with the iron, whilst the metallic Antimony fuses, collects at the bottom of the crucible, and is drawn off into moulds*.

Metallic Antimony has a lamellated structure, a silvery hue running into bluish grey, and displays considerable lustre. Its texture is lamellated. It is brittle and pulverulent, inodorous and insipid; yet, when rubbed between the fingers, it communicates to the skin both a peculiar taste and smell. Its specific gravity is 6·702. It tarnishes and is slightly oxidized when

mixture of clay, iron filings, blood, hair, and alum: and a sheet of iron, rolled up as a cylinder, is used as an adapter. When the distillation is finished, and the apparatus is quite cool, and this iron cylinder is unrolled, the arsenic is found sublimed upon it in brilliant crystals.

* On a large scale, at Riom and Clermont in Auvergne, the sulphuret is first roasted in a reverberatory furnace, then mixed with argol, and the mixture smelted, in a melting pot, in a wind furnace.

exposed to a moist air. It fuses at 810° Fahrenheit, and, in a full white heat, when exposed to the air, inflames and burns with a brilliant white light; and the condensed vapour is a protoxide of the metal—*Argentine flowers of Antimony.*

The only medicinal agents in which Antimony exists, as a direct component, are the *sesquisulphuret*, the *oxysulphuret*, *sesquioxide*, and the *sesquichloride*, which are binary compounds: the *hydro-sulphurets*, the *Potassio-tartrate*, and the other preparations in the Pharmacopœias, are quaternary and quinary compounds. The chemical equivalent of Antimony is 64·6.

Metallic Antimony exerts no action on the animal œconomy.

BISMUTH.

This metal is found, both native and in combination with sulphur, oxygen, arsenic, and other substances, chiefly at Schneebery in Saxony; but some is furnished by Cornwall. Its ores require little more than the application of heat to run the metal from the matrix in which it is embedded.

Bismuth is a brittle, reddish-white metal, having considerable lustre and a lamellated structure. When fused and slowly cooled, it crystallizes in octohedrons. Its specific gravity, at the ordinary pressure and temperature of the atmosphere, is 9·850. It is malleable when warm, fuses at 476° Fahrenheit, and sublimes in close vessels at 30 Wedgewood. It scarcely acts upon the air at common temperatures; but, when fused, it takes up oxygen rapidly; and, when heated to sublimation, in the air, it burns with a bluish flame, and emits copious fumes of the oxide. It readily decomposes nitric acid, and the oxide thus formed dissolves in the acid. The chemical equivalent of the metal is 71.

The only medicinal compound of this metal is the *trisnitrate*, which is a quaternary compound.

Metallic Bismuth exerts no action on the living animal system.

COPPER.

Copper is found native in Cornwall*, and in many other parts of the world; and sometimes, particularly in Siberia, it appears crystallized: it also exists in the form of an oxide, most abundantly in combination with sulphur, and in a saline state. The most common of the ores is the sulphuret named *copper*

* It is a curious fact, that, notwithstanding the great abundance of copper and tin in Cornwall, it is stated by Cæsar, that all the brass used by the Britons, at the time of the Roman conquest, was imported.—See Commentaries "de Bello Gallico."

Copper derives its name κύπρος, from the Isle of Cyprus, where it was first worked. Brass, an alloy of Copper and Zinc, is mentioned in the writings of Moses.

pyrites, in which it is combined with iron; and from which the metal is separated by long-continued roasting in reverberating furnaces:—the sulphur is driven off, partly as sulphur, partly as sulphurous acid. The residue is then oxidized in calcining furnaces, and afterwards smelted with charcoal, which reduces it: but as it still retains both sulphur and iron, it is strongly heated with a current of air playing on its surface, which oxidizes the sulphur and iron, whilst the Copper is left in a state of tolerable purity. The fused metal is let off, through a hole in the bottom of the furnace, into water.

Pure Copper is a hard, elastic, sonorous metal, of a reddish orange colour, insipid, and inodorous except when much rubbed, when it emits a peculiar odour, and has a nauseous, styptic taste: it is susceptible of crystallization and of a high polish. It is both ductile and malleable, and nearly as tenacious as iron. Its specific gravity is 8·667. It fuses at a bright red heat, 1996 Faht. and gives a green tinge to flame. It suffers little change in a dry atmosphere, but is oxidized and converted into a carbonate in moist air. It is an important practical fact, that it is scarcely attacked by sulphuric or hydrochloric acids, and not at all by vegetable acids if the air be excluded: but when the air is not excluded, the Copper is rapidly oxidized, and salts are formed. It rapidly decomposes nitric acid under all circumstances. The chemical equivalent of Copper is 31·6. It inflames when in powder, or otherwise minutely divided, in dry chlorine gas.

The binary compounds of copper are not used as medicines: the *sulphate* is a quaternary compound of the peroxide; and also the *carbonate* contained in ammoniated copper: the *acetate* is a quinary compound.

Metallic Copper does not act on the animal œconomy: instances having occurred in which coins had been swallowed and remained for months in the intestines without producing any injury or inconvenience to the person*.

LEAD.

Lead is very rarely found native in a pure state. Its most abundant ores are sulphurets; but it is found also combined with oxygen, and in a saline form. All the lead of commerce is procured from *galena*, a sulphuret found very generally throughout the world, and abundantly in this country, in Northumberland, Cumberland, Durham, and Yorkshire. In Northumberland this ore is roasted in a reverberating furnace; it is then smelted on a low blast furnace along with lime, which de-

* Thomson's Conspectus of the Pharmacopœias; Art. Copper. Paris' Pharmacologia, p 250. *Orfila*, Toxocol. Générale, i, p. 500.

composes a quantity of sulphate of lead formed during the roasting. The lead of commerce usually contains portions of silver, iron, or copper, from which it should be freed for medicinal use.

Metallic Lead is a soft, flexible, inelastic metal, both malleable and ductile; of a bluish-grey colour. Its specific gravity is 11·381. The surface, from exposure to the air, is generally covered with a white efflorescence, which is a *carbonate* of lead: but, before this occurs, and on a fresh-cut surface, the lustre is considerable. Lead is inferior in tenacity to other ductile metals. Its sp. gr. is 11·35. It fuses at 612°; may be heated to whiteness in close vessels without subliming; and, when slowly cooled, it crystallizes in octohedrons. It is quickly oxidized at high temperatures, and attracts carbonic acid from the air. When submersed in distilled water, it undergoes no change; but when placed partly in air, partly in water, in open vessels, it is quickly oxidized at the point of contact of the air and the water, and carbonate of lead is formed: but the presence of minute portions of any sulphate, or chloride, or phosphate, retards or prevents its oxidizement. It is not acted upon by sulphuric or hydrochloric acids; but it rapidly decomposes nitric acid; and the metal is oxidized at the expense of the acid. The chemical equivalent of lead is 103·6.

The binary medicinal compounds of Lead are the *iodide*, the *chloride*, and the *protoxide* or *litharge*; the saline preparations are the *acetate*, *diacetate*, the *nitrate*, and *carbonate*, which are quaternary and quinary compounds, or combinations of the oxide with the acetic, nitric, and carbonic acids.

Pure metallic Lead is not poisonous when taken into the stomach; but, as it is scarcely ever free from the carbonate, it may prove deleterious; indeed, the carbonate is the only direct poison of lead—a fact which I have clearly ascertained, and shall demonstrate in its proper place.

Mercury is found in various parts of Europe, particularly in Spain, Germany, and Hungary; in South America; in the Philippine Isles, and also in China. The most productive mines are those of Idria, of the Palatinate, and of Guanca Velica, in Peru. Mercury is found native in most of the mines; and, in some, it is in the state of an amalgam with silver; but the most common form in which it is found, is that of native cinnabar, a sulphuret of the metal. The metal is extracted by subjecting the ore, mixed with lime or iron filings, to the action of heat:

* Named from υδρο, water, and αργυρος, silver.

the lime, or the iron, combining with the sulphur, sets the mercury free, to be volatilized in the metallic state.

The distinguishing characteristic of Mercury is the fluidity which it maintains at common atmospheric temperatures. It has a white colour and a strong lustre, and its purity is ascertained by the complete mobility of all its particles. It becomes solid or congeals at 39° below Zero, and contracts greatly at the instant of congelation: in this state it is malleable and may be cut with a knife. The specific gravity of fluid Mercury is 13·5, that of solid Mercury 15·612. At 656° Fahrenheit, this metal boils, and is volatilized.

Pure Mercury is very slowly oxidized by exposure to air and moisture at an ordinary temperature; but when alloyed with lead, it is rapidly oxidized; and in a temperature sufficient to volatilize the metal, it is converted into a binoxide. Mercury burns in dry chlorine, at a temperature of 340°, and is converted into the bichloride; but it combines with chlorine in two proportions, forming a *Chloride* as well as a *Bichloride*. It decomposes the sulphuric acid by the aid of heat, and the nitric acid at the ordinary temperature of the atmosphere: but it does not affect any other acid. The chemical equivalent of Mercury is 202.

The medicinal agents in which Mercury exists as a compound are numerous: the binary compounds are the *chloride* and *bichloride*, the *iodides*, *sulphurets*, *cyanides*, *protoxide*, and *binoxide*; the salts, which are also numerous, are quaternary compounds of the acids and the oxide.

Although the preparations of Mercury are most active medicines, yet the metal itself exerts no influence whatsoever on the living system.

SILVER.

This metal is most abundantly procured in tropical regions: it occurs native, both massive, dendritic, and crystallized; and in combination with other metals, as gold, antimony, arsenic, bismuth, tellurium, lead, iron, and copper. Sulphur is also a component of some ores of Silver. The greater part of the Silver of commerce is obtained from native Silver and its sulphurets. The ore is reduced to fine powder, mixed with sea-salt, and exposed to heat in a reverberating furnace: a sulphate of soda and a chloride of silver are thus formed; the whole is then ground together, and the powder, being mixed with mercury, water, and fragments of iron, is put into barrels which revolve by means of machinery. The chlorine of the chloride of Silver is taken by the iron, which is thus converted into a soluble salt, and the Silver amalgamates with the mercury, which is after-

wards separated by distillation, leaving the Silver in a pure state. From the ores of Galena, it is procured by roasting, smelting with charcoal, and cupellation. It may also be procured pure enough for medicinal use, by precipitating Nitrate of Silver by means of a piece of copper put into the solution. The precipitate should be washed in Ammonia to take up any copper that may be thrown down.

Pure Silver is a soft, malleable, ductile, very tenacious metal, of a clear white colour, inodorous, tasteless, and susceptible of a high polish. Its specific gravity, at the temperature of 60° and the ordinary barometrical pressure, is 10·51. It fuses at 20 Wedgewood; and in a very high temperature is volatilized. It does not decompose air or moisture; and, even in the melted state, when it is exposed to a current of oxygen gas, it is not permanently oxidized; the oxygen which it has attracted being again given out as it solidifies. Silver acts upon none of the acids, except the sulphuric and the nitric; the latter of which is its proper oxidizing agent and solvent. The chemical equivalent of Silver is 108.

The only preparations of Silver medicinally used are the *protoxide* and the *nitrate*. The latter is a quaternary compound of the protoxide and nitric acid, and requires to be made from pure silver.

GOLD.

The knowledge of this metal is of such remote antiquity, that it is supposed to have been the first with which mankind became acquainted. It is found native, and alloyed with other metals. The most common alloys are those of silver, in which it exists in various proportions from 8 to 70 per cent.; copper; and iron. The principal mines are in South America; but its ores are also wrought in Hungary and the Uralian mountains in Siberia.

Gold is separated from its ores, after freeing it from stony matters by stamping and washing, either by fusing it with lead and afterwards submitting the compound to cupellation; or by amalgamation with mercury, and distilling the compound. To free it from silver, the alloy is treated wth nitric acid, which dissolves out the silver.

Pure gold has a rich, deep yellow colour, a considerable lustre, and a specific gravity 19·3. It is soft, ductile*, malleable†, and fuses in a temperature of 1016 Faht‡. In the native state it is found in cubical crystals. It is permanent in air, dry or moist:

* One grain may be beaten out so as to cover 56 square inches.
† One grain may be drawn out into 500 feet of wire.
‡ In a state of fusion, it has a greenish colowr.

and resists the action of all the simple acids, even when boiled in them; but it is soluble in nitro-hydrochloric acid, or rather in the chlorine which it contains. The chemical equivalent of Gold is 199·2.

The therapeutical preparations of Gold are not found in the British Pharmacopœias. They consist of *chlorides, iodides, cyanides*, and a double salt, a *terchloride of Gold and Sodium.*

Gold in a minute state of division is supposed to operate as an excitant to the animal system*; but this opinion wants confirmation. Its preparations are powerful stimulants, resembling the mercurial salts in their influence as medicinal agents.

* Niel, Recherches et Observ. sur les effets des preparations d'Or. Paris, 1821.

PART III.

SECTION I.

CLASSIFICATIONS OF MEDICINAL AGENTS, FOUNDED ON THEIR OPERATION.

The advantages of an arrangement of Medicinal Substances, or, in other words, of the Materia Medica, founded on their medicinal operation, is undoubted. But, in order to render such an arrangement useful, it is requisite that he who would acquire an accurate acquaintance with the nature and properties of medicinal substances must not only draw largely on the stores of Natural History and Chemistry, but, in order to comprehend the laws of the action of medicinal agents on the living system and their therapeutical influence in disease, he must also have recourse to the aid of Anatomy and Physiology.

The arrangement of Medicinal Substances adopted in this volume is founded upon the basis of their operation on the body. Before explaining the principles which have regulated its formation, I shall present my readers with what I conceive to be the two best modern classifications of medicinal substances, and offer a few comments upon each of them, to justify the alterations which I have made in framing my own.

The first of the two classifications to which I have alluded is that of Dr. Young, as exhibited in the following table:

I. Chemical Agents.

1. *Caustics.*
2. *Antiseptics.*
3. *Antidotes.*
4. *Demulcents.*
5. *Diluents.*

II. Vital Agents.

A. Supporting Strength.

1. *Nutrients.*

B. Causing Action.

Partial and Transient.

1. *Expergefacients.*
2. *Excitants.*
3. *Calefacients.*
4. *Sudorifics.*
5. *Errhines.*
6. *Sialogogues.*
7. *Expectorants.*
8. *Stomachics.*
9. *Emetics.*
10. *Cathartics.*
11. *Chologogues.*
12. *Hydragogues.*
13. *Simply Propellents.*
14. *Anthelmintics.*
15. *Diuretics.*
16. *Carminatives.*
17. *Emmenagogues.*
18. *Epispastics.*
19. *Suppuratories.*
20. *Sorbefacients.*
21. *Astringents.*

Permanent. *Tonics.*

C. Diminishing Action, or Sensation.

Primarily: 1. *Narcotics.* 2. *Sedatives.* 3. *Nauseants.* 4. *Diaphoretics.*

Secondarily: *Exhaurients.*

III. Insensible Agents.

Specifics.

In the foregoing table, Dr. Young has arranged all the objects of Materia Medica under three distinct heads: Chemical Agents, Vital Agents, and Insensible Agents. The propriety of the first and second of these primary divisions cannot be denied; but, as the existence of specifics is questionable, the third is certainly objectionable. The arrangement, however, of the classes is even less commendable than that of the primary divisions. The first division contains five classes, two only of which, Caustics, and Antiseptics if any really exist, can be correctly considered as operating chemically on the body. With

respect to the class Antidotes, it is only necessary to remark, that all substances which may be considered as such do not act chemically; and it is still more difficult to comprehend how Demulcents and Diluents can be regarded as chemical agents. The second division, *Vital Agents*, is less objectionable; but it is too much subdivided, and contains too many classes. In the second section of this division, entitled "causing action," we find Expergifacients, Excitants, and Calefacients, as distinct classes, which is not easily understood, as the terms are nearly synonymous, and the same medicines must be arranged under each to answer the indications implied. The class Chologogues, or purgers of bile, cannot properly be separated from Cathartics, most of which, as they operate more or less on the duodenum and the gall-ducts, may, in fact, be regarded as Chologogues. The same remarks apply to Hydragogues; for as Cathartics, except those of the mildest description, never operate without throwing off a large portion of fluid by the bowels, by stimulating the intestinal exhalents; thence a distinct class of Hydragogues is superfluous. The class Suppuratives consists of substances which are, in fact, merely varieties of Epispastics. In the second section, therefore, of this division, the *first*, the *third*, the *eleventh*, the *thirteenth*, the *nineteenth*, and *twentieth* classes might be advantageously omitted; and, with equal benefit, the class Exhaurients, in the third section, might be expunged. No class should be admitted in any arrangement of the Materia Medica which is not essentially different from the others; nor any which is founded on the basis of hypothesis. In my opinion, Dr. Young has judiciously separated Narcotics from Sedatives, for reasons which I shall afterwards have occasion to detail in speaking of my own arrangement.

The following table displays the second of the Classifications to which I have alluded, namely, that of Dr. Murray.

A. General Stimulants.		
	a. Diffusible.	Narcotics. Antispasmodic.
	b. Permanent.	Tonics. Astringents.
B. Local Stimulants.		Emetics. Cathartics. Emmenagogues. Diuretics. Diaphoretics. Expectorants. Sialogogues. Errhines. Epispastics.

C. CHEMICAL REMEDIES.	Refrigerants. Antacids. Lithontriptics. Escharotics.
D. MECHANICAL REMEDIES.	Diluents. Demulcents. Emollients. Anthelmintics.

This Classification of Dr. Murray is also framed upon the basis of the operation of the substances employed as remedial agents; and, with a few exceptions, it is almost as perfect as the present state of the healing art will admit. Objections, nevertheless, have been advanced to some of its classes, and to the positions which others hold. Thus, the position of the class Refrigerants among the chemical remedies has been justly criticised; and the fallacy of the views upon which its place has been allotted to it by Dr. Murray shall be pointed out when Refrigerants are treated of. A tenable objection has also been made to the class of Lithontriptics. No medicines introduced into the stomach have yet succeeded in wholly or partially dissolving calculi, existing either in the pelvis of the kidneys or in the bladder of urine; although it is said to be a well-attested fact, that the angles and asperities on the surfaces of renal calculi have been occasionally smoothed down by the long-continued administration of some of the substances included in this class. Means, also, have been devised for applying substances known to dissolve renal calculi out of the body directly to calculi contained in the urinary bladder. But, unless the evidence of their solvent powers were conclusive, a class of Lithontriptics is scarcely admissible. Upon the whole, however, Dr. Murray's Classification is superior to any of its predecessors; and it will be seen that I have adopted it as the general basis of my own arrangement.

In framing the table which will be found at the end of this section, although I have taken advantage of the arrangements of Dr. Young and of Dr. Murray, yet it will be obvious to my readers that my view of the subject is different from that of either of these distinguished medical philosophers. I have adopted one of the primary divisions of Dr. Young and two of those of Dr. Murray: arranging the whole of the Materia Medica under three sections, namely, *Vital*, *Chemical*, and *Mechanical Agents*. In the first of these divisions, I have discarded many of the classes of Dr. Young, and have altered the position of others. I have also changed the situation which Narcotics, Antispasmodics, and Refrigerants, hold in Dr. Murray's arrangement; and have divided Narcotics, into Narcotics properly so called, and Sedatives. With regard to the propriety of this

disunion, I trust that I shall be able to convince my readers that there are medicinal substances which diminish or destroy the *irritability* and *sensibility** of the body; and, consequently, lessen the action of the heart and arteries, both in strength and frequency, or extinguish it altogether, without having caused

* As these terms will frequently recur, it is proper that the reader should be fully aware of what is intended to be understood by them in the following pages.

Irritability is that property of some organic structures, connected with or dependent on vitality, which renders them capable of being excited to contraction, either on the application of external stimulants, or by the will. It is displayed particularly in the muscular fibres; and, to use the language of Blumenbach, "is marked by an oscillatory or tremulous movement, differing from the action of simple contractility, both by occurring far more easily on the application of any pretty strong stimulus, and by being attended with a much more considerable constriction." Some physiologists—as Haller, Fontana, Sœmmering, Nysten, and Bichat, for instance—have attributed this solely to a principle adherent in the fibres of the muscles; and regarded it as altogether independent of the nervous system. Others—as Dr. Whytt, Dr. Cullen, Monro, Prochaska, Legallois, Reil, and others—on the contrary, considered it as dependent on the nerves distributed to these organs.

The theory of Haller rested chiefly upon the fact, which he had observed, that contraction cannot be produced in the heart, and other involuntary muscles, by the application of stimulants to the trunks of their nerves; from which, and from the results of his experiments, he was led to believe that the irritability of the muscular fibre is a vital property, peculiar to muscles, of a nature different from sensibility, and not derived from the nervous system; whilst, at the same time, he admitted that the voluntary muscles, besides this inherent irritability, possess also a *vis nervosa*, or contractile power, excitable by stimulants applied to their nerves. The proofs brought forward by Haller and his followers have been demonstrated to be of no value; especially in reference to the heart, which does not act independent of nervous influence. Humboldt and Burdach succeeded in modifying its action through the cardiac nerves. It is probable that Haller was led to form his opinion from losing sight of the suggestion of Erasistratus and Galen, which has been verified by the distinguished Bellingeri in Italy, and Sir C. Bell in this country, that there are distinct nerves of sensation and of motion. When we reflect that the nervous system was then supposed to be possessed of the same powers in all its parts, it is easy to conceive that a physiologist, when he saw motion rendered evident without sensation, should conclude, as Haller did, that both irritability and the *vis nervosa* resided in the muscular fibre. Tiedemann, who accords with Haller's opinion of muscular irritability, supposes the maintenance of this property to be dependent on nervous influence[1]. And, after all the experiments that have been instituted to prove each side of the question, there is no demonstrative evidence that the contractility of muscles does not depend on a vis insita, by whatever name it is designated: but this manifestation of this property "presupposes a concurrent action of the nerves[2]."

To the same cause which influenced Haller, namely, ignorance of the distinction between nerves of motion and of sensation, we may trace the error into which Dr. Whytt has fallen, in combating the theory of Haller, when he asserts that the motions of stimulated muscles proceed from their sensibility; that the irritability of the muscular organs of the body is in proportion to their sensibility; and, consequently, that whatever augments the sensibility of muscles, increases their irritability; whatever diminishes their sensibility, lessens or wholly destroys their irritability. It is certain that many of the experiments of the present period, particularly those of a galvanic nature, tend to confirm the opinion that *irritability* is a property inherent in, and peculiar to, the muscular tissue.

But, perhaps, the most powerful argument that can be advanced in favour of this proposition may be drawn from the fact, that, when paralysis ensues on tying or dividing the nervous trunks of a muscular organ, the irritability continues vigorous for a considerable time afterwards.

[1] Physiologie, t. i, p. 547.

[2] Muller, in whose work (Elements of Physiology) the opposing opinions are admirably examined. See Baly's Trans. p. 896—9.

any perceptible previous excitement: such medicines are, therefore, justly entitled to the appellation Sedatives. With regard to Refrigerants, which I have removed from amongst the chemical remedies in Dr. Murray's table, there can be no doubt that they ought to be placed under the head of vital agents diminishing action, when we consider the effects of cold in lowering the powers of life. Thus, a stream of cold water directed upon the crown of the head, and continued for a considerable time, is

It would be out of place here to proceed further with this argument: I have, therefore, merely to state, that by the term *Irritability* I mean that *vital* property of organic structures which renders them capable of being excited.

The term *Sensibility* has been employed by Chaussier, a French physiologist of great eminence, and by some other physiologists, to express that faculty, which every living fibre possesses, of changing, by any impression or contact, its habitual and natural harmony or disposition of parts; thus making it equivalent to contractility and irritability conjoined. This, however, is not the sense in which the word will be employed in this volume; but, approximating to the common acceptation of the term, I shall use it to express that property of the animal body, dependent on the nerves of sensation, which is the cause of a perception in the mind when a stimulant is applied to a part furnished with certain nerves. This change in the corporeal organ is always accompanied by a definite idea; and the same idea is the necessary sequence of the same action, whether this be the result of the application of any external stimulant or an internal cause, as long as the organ on which the impression is made remains in a healthy condition. It is unessential, for the truth of this position, to determine in what the change upon the extremity of the sentient nerve consists, and in what manner it is propagated to the brain; whether by a vibratory movement in the nervous cord, or the undulatory action of a fluid contained within it, or the power of electricity conveyed along it. All that is certainly known, is, that the change is the result of a specific action on certain nerves only; and this is necessary to be always borne in remembrance. This fact, which the experiments of Bellingeri and Sir Charles Bell have firmly established, first suggested itself to Erasistratus[3]; but so little was his opinion the result of anatomical inquiry, that he imagined that the nerves of sensation originated in the membranes, those of motion in the substance of the brain. Galen maintained a similar opinion regarding two sets of nerves, and supposed that the sensory nerves arise from the cerebrum, the motory from the cerebellum[4]. These opinions were revived by M. Pontean[5], M. Lecat, M. Morin, and other moderns: however, they can only be regarded as happy conjectures: nor do they, in the smallest degree, detract from the merit of the distinguished physiologists who have confirmed the vague ideas of the ancients by following the only path which can lead to truth—that of experiment and observation[6].

All sensation is undoubtedly dependent on the presence of nerves; and every hour's experience confirms the opinion of Galen, that the degree of sensibility which any part of the body possesses is proportional to the number of nerves which it receives.

That sensibility is distinct from *irritability* is evident; for a muscle, in which all *sensation* is destroyed by a division of the sensitive nerve supplying it, is, nevertheless, still irritable, or enjoys the capacity of being stimulated to contraction. Sensibility is, therefore, a matter of consciousness: irritability is not necessarily so; but, in a part which is endowed with both, the former is greatly heightened in an increased state of the latter. Thus, on a highly irritable surface, impressions which, in a more healthful state of the part, would be either indifferent or pleasurable, excite pain and often inordinate action. *Sensibility*, as I employ the term, differs further from irritability and contractility in being peculiar to animals; whereas both irritability and contractility are properties of all organized bodies, whether animals or plants.

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[3] Rufus Epesius, de Partibus Hominis, p. 65, edit. Lond. 1726.

[4] Galen de Anatomicis adminis. lib. vii, viii, quoted by Dr. J. Thompson in his Life of Cullen, vol. i, p. 205, 207.

[5] Œuvres Posthumes, t. ii, p. 480.

[6] Exposition of the Natural System of the Nerves, 8vo. London, 1824.

a sedative of such power that it immediately subdues the excitement of Phrenitis; instantly reduces the morbid strength of the most athletic; and is, consequently, dangerous when incautiously employed. But it may be said that cold, in a diminished degree, exerts a tonic influence. This is correct: nevertheless, its depressing influence, and that also of those remedies which produce a cooling effect upon the body when taken into the stomach, is so striking, that I consider myself warranted in placing Refrigerants in the same division as Sedatives; that is, under the head of Vital Agents, which operate on the nervous system by directly diminishing action. In the first section of Vital Agents, therefore, those influencing the body generally by operating directly upon the nervous system, the substances possess two distinct modes of acting: one which may be regarded as *positive*, which is followed by excitement; the other as *negative*, which is followed by immediate collapse: and it is from a conviction of the accuracy of this view of the subject, that I have arranged them as they stand in my table.

The manner, however, in which Vital Agents influence generally the body as remedies is not the same in all of them; consequently, subdivisions are requisite. I have, therefore, arranged the sub-sections according as the substances which they include operate directly on the *nervous* system; or, through its influence, on the *muscular* and the *sanguiferous* systems; or on the *secerning* system.

The second section of the first division comprehends those topical Excitants which influence the body chiefly by their local action.

With respect to the Classes I am perfectly sensible of the impossibility of strictly arranging them according to physiological principles. Thus the Class Sialogogues might have been included in that of Excitants: but, as the most striking effect of the former is produced upon the salivary glands and little upon the other secreting organs, I have preferred making the direct Sialogogues a distinct Class, and placing it in the third subdivision. In the same manner, several of the other Classes may be regarded as entitled to rank in other subdivisions as well as in that in which they appear: but it is impossible, in any arrangement, to take under consideration all the variations which may present themselves. The chief object of any classification is to enable the student to pursue his investigations with method; and I trust that the one which I have adopted will prove adequate for this purpose. It is not offered as a *perfect* classification; on the contrary, I am satisfied that the progress of Materia Medica will unveil its defects.

In the second general division of the table, that intended to comprehend those medicines which influence the state of the body, or its contents, by their *chemical* properties, I have kept in view only those medicines the primary action of which is chemical; the body or its contents being regarded as one of the

agents of the action induced. Thus, as far as regards Escharotics, the chemical affinities of the substances employed as such are sufficient to overcome the preservative influence of the vital principle; and the solid parts of the body enter into combination with these substances, during their action, in the same manner as if they did not form a portion of the living system. I have subdivided this division, therefore, according to the nature of the chemical action of the substances contained in it. Thus, Escharotics exert a solvent power, and combine with the animal matter; or rather, by a resulting affinity, separate the elements of the part to which they are applied, and cause them to enter into new combinations.

In the same manner, the action of Antacids and Antalkalies is as truly chemical as if the operations, instead of taking place in the body, were performed in the laboratory. The influence of Antilithics is not so obvious, and their mode of action not so readily explained; but it is undoubtedly, in part, chemical.

In making these general remarks on the second division of my arrangement, however, it is necessary to admit that the remedial effects of some of the substances arranged under it are not confined to their chemical action. Thus, the benefit derived from the operation of an Escharotic does not result from the chemical phenomena which accompany it, but solely from the stimulus which it causes operating as a counter-irritant; the chemical action being no further remedial than as it produces the eschar by the sloughing of which the issue is to be formed: it is the counter-irritation which is the remedial power. Neither can the beneficial influence of Antilithics be wholly ascribed to their chemical properties; somewhat is due to the tone which they impart to the stomach, improving the digestive function and preventing that acescent condition of the viscus which favours the formation of calculous matter and its consequent deposition in the urinary organs.

Little remains to be said respecting the third division of this arrangement. It cannot be regarded as of an active nature. The medicines arranged under it operate rather by a kind of *negative* property, not affecting either the nervous system or the simple animal fibre directly, than by any quality inherent in themselves. They prove beneficial by diminishing the action of acrid and stimulating matters upon diseased surfaces; and they effect this by interposing themselves, as it were, between the acrid and stimulating matters and the sentient extremities of the nerves of the organs to which they are applied: they may, therefore, be regarded as mere mechanical agents, although it be not easy to explain their influence upon distant parts with a reference solely to their mechanical action, unless we refer to those in the class *Diluents,* which, being taken into the circulating mass, and carried to every part of the habit, act on each organ as if they were immediately applied to it.

I have purposely avoided extending the following table by introducing the subdivisions of the Classes; conceiving that the student will derive more advantage from tables of these placed at the head of each Class, than if they were crowded into the general table.

It is only necessary to remark farther, in this place, that each Class will be divided into three primary divisions, according as the medicinal agents are PONDERABLE, embracing both *organic products* or *inorganic* substances, or IMPONDERABLE, comprehending some *operations* and *mental agents*. I am aware that objections may be advanced to the last of these divisions, as far as regards mental agents: but, as these have a powerful influence in the removal of diseases, they become instruments in the hands of the Physician as applicable, in a theoretical point of view, as the material articles of the Materia Medica, as curative agents; and, consequently, when they present themselves, they will form part of a third and distinct division of the Class in which they may be arranged.

TABLE OF CLASSIFICATION.

I.—Vital Agents.

A.—Influencing the body generally;

a.— by operating directly on the nervous system:

* *increasing action:*		Excitants.
* * *diminishing action:*	*Primarily.*	Sedatives. Refrigerants.
	Secondarily.	Narcotics. Antispasmodics.

b.——on the muscular and sanguiferous systems:

Tonics.
Astringents.
Emetics.

c.——on the secerning and exhalant systems:

Errhines.
Sialogogues.
Expectorants.
Cathartics.
Diuretics.
Emmenagogues.
Diaphoretics.

B.—Influencing the body by their topical action.

Epispastics.
a. Rubefacients.
b. Vesicants.
c. Cauterants.

II.—Chemical Agents.

A.—Influencing the body, or its contents, by their chemical properties:

* *acting on the animal solid:*	Escharotics. *a. Erodents.*
* * —— *on the contents of cavities:*	Antacids. Antalkalies. *a. Antiseptics.* Antilithics.

III.—Mechanical Agents.

Demulcents.
Diluents.

SECTION II.

VITAL AGENTS.

THE application of the term *Vital Agents*, in the present instance, is confined to substances which operate upon living animal structures. The animal body is composed of solid and of fluid parts, displaying, in a general point of view, the same physical properties as all other solid and fluid matter. Thus, every solid part of the body is an aggregation of molecules, which do not separate from one another, except by the influence of some agent acting upon them, either within or without the body; and the whole is made up of such aggregations, differing in *consistency*, *elasticity*, and *tenacity*, under the form of bone, muscle, membrane, ligament, vessel, and nerve. So far animal structures correspond with inert matter; but they differ from it in one essential: their solidity does not wholly depend on physical causes. In inorganic bodies, the force of cohesion is the sole power which maintains them in a state of solidity: but in organized bodies this is altogether secondary to that unknown principle which we denominate *life*, which is obvious to us by its effects, although its nature will probably remain for ever undiscovered by the powers of human reason. If, for example, a muscle be separated from one of its attachments in an animal body, and as great a weight appended to it as it can support, it will be found that the same muscle, after having been separated from the body, for a space sufficient to destroy its vitality, but not to permit of decomposition, will be unable to support the weight which it sustained when alive: clearly demonstrating that the principle of vitality has more power in maintaining the integrity of animal structures than cohesion. The maintenance of this principle requires the presence of what have been termed *vivifying stimuli;* for " the vital force is manifested in an animal only while certain stimuli produce in the living tissues constant material changes, of which the phenomena of life are merely the external signs*." It is upon animal structures, imbued with this principle, that the medicines which we are about to examine under the title of *Vital Agents* operate; and, when this principle is withdrawn, these agents cease to influence the animal frame†.

A question here presents itself—do vital agents produce their effects by a direct action on the living tissues? Is the

* Muller's Elements of Physiology, translated by Bayly, vol. i, p. 38.

† It is not, however, necessary, that this principle should manifest itself by the phenomena of life: it may remain quiescent, as in the seeds of plants, and, by the action of vital stimuli, become active; but, as soon as this occurs, the continued influence of these agents is necessary to maintain its existence, although it does not require them for the maintenance of its quiescent existence.

muscular fibre affected by the direct operation of the stimulant upon it, independent of the nerves, which, there is every reason for believing, accompany it in every structure in the organism of the body? There is much difficulty in replying to these questions; and it would be digressing too widely from our proper subject to venture upon a minute examination of the facts which lead to the conclusion, that the cellular and the muscular fibre are affected by medicinal agents chiefly through the medium of the *nerves*. It is only necessary to remark, that no efforts have yet succeeded in separating the nervous from the muscular and the cellular fibrils; and that muscular action is greatly modified by causes operating primarily on the brain, or on the nerves leading to the muscles, whether the action be voluntary or sympathetic; and this fact of itself is sufficient to justify the inference, that those medicinal agents which I have termed *vital*, influence the body chiefly by their action on the nervous system. This opinion, indeed, is founded upon the same basis as the Pathology which now almost universally regulates the opinions of the profession; and which arose with the ideas first taught by Hoffman regarding the nervous origin of diseases.

Admitting that the action of medicines almost wholly depends upon motions excited in, and propagated by, the nerves, the medicines capable of inducing such motions operate either generally, or upon particular parts. Those which, however, it must be remarked, influence the body generally, exert also a primary action on particular parts; and this may either originate from an immediate impulse upon the nerves, or upon the muscular and sanguiferous systems, or upon the secerning system. In whatever manner the impression is made, the energy of the whole nervous system is excited; and it is by this means that the various effects which result from the administration of medicinal agents, whether they are absorbed or not, are produced in the different parts of the body.

It was at one time supposed that the energy of the whole nervous system depends on the brain; and even Dr. Cullen remarks, in speaking of the operation of medicines, that "all powers, noxious and salutary, operate not only upon the parts to which they are applied, but also upon distant parts of the system, and that by the intervention of the brain; and these causes are therefore to be considered as exciting the action of that organ." It has also been supposed that sympathies can only be explained by admitting that the primary impressions of external agents act on the brain; and that it is from the reaction of this organ that subsequent motions are produced in other parts of the œconomy. But there are exceptions to this explanation of the communication of impression made by vital agents on particular parts; for, without referring to the lower animals, those placed in the class *Vermes* of Linnæus, and the *Radiata*

of Cuvier, in which there is no brain, we find, in man himself, that the powers of the brain are shared by the spinal marrow; and it is not impossible that, although the nerves are, properly speaking, *transmissive* organs, or conductors, yet, that *they* themselves are possessed of a certain degree of power, independent of that either of the brain or of the spinal marrow. We know that after the communication between the brain and the spinal cord is cut off by dividing the nerves supplying any muscles, contractions in these may be excited, for a certain time, by irritating the separated nerves. In reference to the brain itself, the excitability resident in nerves is rendered evident by the observations made on acephalous infants, in some of which, although the brain was altogether wanting, yet, not only the instinctive functions were performed, but food was taken; which undoubtedly implies some degree of consciousness. "By shewing us," as Mr Lawrence has justly remarked, "what happens when an important organ is wanting or malformed, it contributes to fix our opinions respecting its uses*." The independence of the excitability of nerves on the brain is also partly confirmed by the experiments of Fleurens, Rolando, and other continental Physiologists, in removing portions of the brain. The experiments of Sir Benjamin Brodie and those of M. Gallois have farther proved that the action of the heart is carried on completely independent of the brain; and, in fact, that the source of the motion of the heart is an influence exerted upon it by the medulla spinalis.

But this is not the place to notice these investigations: it is enough for us to know that those medicinal substances which are comprehended under the term *Vital Agents* produce their effects by influencing the nervous energy—that power inherent in the brain, in the medulla spinalis, and in the nervous system generally, by which not only all the vital actions are maintained, but through which, also, we are willing, moving, and conscious beings.

SECTION III.

EXCITANTS—MEDICAMENTA EXCITANIA†.

Syn. Stimulants.

Excitants may be defined "Substances that augment, powerfully, the motions peculiar to the different organs of the body,

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* Medico-Chirurgical Transactions, vol. v, p. 176.

† From the Latin word *excitare*, to excite, to awaken.

by an impulse on the sensibility and irritability of the part to which they are applied, communicated by the nerves, in some instances, to the whole system."

That the effects of Excitants differ according to the nature of the organ they influence, is readily demonstrated. Thus, whether the Excitant which is applied to a muscle, or the motor nerve suppling it, be mechanical, chemical, electrical, or mental, it causes the same action,—namely, motion; applied to a sentient nerve, pain is excited: to a nerve of sense, either the sensation of sound, or of light, or of taste, according to the description of nerve impressed, is experienced. Even in a morbid condition of an organ, as long as it is capable of manifesting its peculiar vital properties, the same results will follow the action of Excitants. All Excitants within a certain limit of intensity may be regarded as *renovating* agents; beyond it, as *destructive* agents. Thus, electricity of a moderate power is capable of restoring a paralyzed limb; in excess, it instantly extinguishes the vital flame.

Excitants, whether of an animal or a vegetable nature, or inorganic substances, have some sensible properties in common. They impart a warm or an acrid impression on the organs of taste; and, when they are of a vegetable nature, they are generally odorous. These qualities have been regarded by several writers on the Materia Medica as constituting the essential properties of every Excitant. There are, nevertheless, inorganic Excitants which, correctly speaking, have neither taste nor odour; as, for example, *Caloric* and *Electricity*; but the impulse which they impress on the nervous system differs rather in degree than in kind from that which is communicated by aromatic substances. In the vegetable kingdom, the exciting agent, whenever it can be isolated from the other principles of the plants that contain it, produces all the effects of the entire plants in an increased degree.

The inorganic substances belonging to this class of medicines appear to have no principle in common to which their action can be referred.

The general effects of Excitants are very obvious. They consist in—1, a greater susceptibility to impressions in the nerves; 2, an increase of action in the moving fibres; 3, an acceleration of the pulse, and an augmentation of its force; 4, an elevation of the temperature of the body. The organs upon which they chiefly display their influence are those of digestion, circulation, respiration, and secretion. In small doses, the action of Excitants is scarcely perceptible, and it is confined to the surface to which they are applied: in large doses, it becomes obvious, not only to the individual excited, but to others; and the effects of their action is extended over the system. In still larger doses, their effects assume the character of disease. Thus, the first effect experienced after taking a strong Excitant is a

sensation of heat and acrimony in the gullet, extending to the stomach and causing thirst: the digestive function is evidently suspended; and nausea, sometimes vomiting, supervenes. The substance, if not ejected, is rapidly carried into the duodenum, and increases the peristaltic movement of the intestinal canal. These effects, however, do not always depend on the extent of the dose of the Excitant; but, in many instances, on the condition of the body of the person to whom it is administered.

1. Excitants, when taken into the *stomach*, exert their primary action on that organ; a sensation of heat is experienced, which the person affected instantly refers to the stomach; and it is probable that the mucous membrane, if the viscus could be seen, would be found redder than natural and more sensitive, and the muscular coat contracted. If the stomach be empty, a sensation of hunger is felt; and if food be immediately afterwards taken, or if the exciting substance be swallowed directly after taking food, the digestive faculty is rendered more active. From the stomach, the impulse is communicated to other parts of the system; but the general result is not in every case commensurate to the impression made upon the stomach; and many Excitants which act powerfully on the general habit, display little influence on the organ receiving their primary impulse. If Excitants pass the pylorus without acting on the stomach, their influence on the general system is less than when their primary impression is made on the stomach. The cause of this is connected with the functions of the part and the nature of the stimulants which thus operate. As far as regards the functions of the part, the natural effect of a moderate stimulant on the intestinal canal is to increase its peristaltic motion; the stimulating substance is, consequently, carried forwards; and although it continues its impulse as it proceeds, yet, this is too transitory to be very influential. As far as regards the nature of the stimulants which operate in this manner, if they are vegetable substances, the aromatic principle is so involved in the other components that the digestive process must be exerted to a certain extent before it is evolved; and this does not happen until the substance has passed out of the stomach.

2. *Excitants affect the Circulating and the Respiratory Organs.*—Some stimulants, chiefly those of an inorganic nature, exert little influence until they are taken into the circulation; thence they may be said to communicate their impulse directly to the heart and the arteries. The influence of certain impressions on the stomach, however, is to augment, also, the force of the heart and arteries in affecting the circulation of the blood: thence, when an Excitant is swallowed, it renders the pulse both quicker and stronger than before; and the impulse thus impressed is extended even to the capillaries. Red blood is impelled into channels in which, under ordinary circumstances, it is absent; the skin is therefore

reddened, its temperature is elevated; and, if the dose of the stimulant be considerable, restlessness, watchfulness, and headache supervene. If we admit that the rhythmic contractions of the heart is due to nervous influence,—a presumption which is rendered probable by the fact, that the contractions continue when the organ is separated from the body, and is consequently empty of blood,—we must also admit that the effects just described are dependent upon the influence of the excitant on the nerves supplying the heart*. It is equally evident that they are necessarily proportionate to the dose of the Excitant; although other circumstances also, in some degree, modify them. Thus, Excitants act with much energy in persons of sanguine temperament, as far as concerns the circulating system: whereas, in those of an opposite frame of body, their power upon the heart and the arteries is often scarcely perceptible. The influence of mental Excitants, operating on the circulating organs, through the nerves, is remarkably exhibited in blushing; in the injection of the vessels of the whole head in violent anger; in the erection of the penis under the influence of the sexual appetite; in palpitation of the heart, and in that sensation of a glow of heat overspreading the chest which often attends highly agreeable or pleasurable feelings.

The natural consequence of an accelerated condition of the pulse is an increase in the movement of the thorax: a greater number of inspirations and expirations than usual occur in a given time; thence a more complete change takes place in the blood circulated through the pulmonary vessels. It is from observing these phenomena, when Excitants are administered, that they are asserted to influence the respiratory organ.

3. *Action of Excitants on the Secerning System.*—I have already stated that Excitants taken into the stomach increase the action of the capillaries; thence they awaken, as it were, the activity of the secretory and exhalant systems. They act powerfully on the kidneys; and, therefore, all Diuretics are Excitants: on which account, some volatile oils, when taken in a large dose, cause distressing effects upon the urinary organs. The influence, also, of the passions of the mind on the secretions, and the fact, that the sight or the odour of savoury food excites the salivary secretion, are further proofs.

4. —— *on the Nervous System.*—That Excitants display the most obvious effects of their power on the nerves is undoubted.—Almost immediately after any exciting substance, in a sufficient dose, is taken into the stomach, the impulses communicated to

* We cannot indeed explain this without supposing, with Muller, that " the heart under these circumstances retains with its nerves some specific nervous influence. The influence of the nerves, therefore, appears to be the cause of its contractions; and this seems to be confirmed by the great effect which irritations of the brain and spinal marrow, and passions of the mind, have in modifying the action of the heart."—*Muller's Elements of Physiology; Baly's Trans.* vol. i. p. 191.

the nerves of that organ are transmitted to the rest of the body, developing vital energy in the various anatomical centres to which the nerves relate. All Excitants, however different they may be from one another, operate in the same manner, all influencing the excitability of the nerves. They cause sensation when applied to sensitive nerves, motion when to motor nerves. In the former instance the excited nerve requires its communication with the brain or spinal cord to be uninterrupted; in the latter this is not essential, if the integrity between the point of the nerve which is excited and the muscle to which it leads be preserved. Excitants also introduced into the blood act on the excitability of the nerves: thus, Tartar emetic when injected into the blood vessels causes vomiting: the inference to be drawn from which is, that some Excitants may influence the nerves after their absorption from the stomach, although they display no obvious influence on the nerves of that organ.

We cannot explain this power of transmitting impressions inherent in the nerves. We acquire no information from our knowledge of the structure of the nervous tissue:—from the brain to the minutest nerves, we find that it is constituted of two distinct substances; one, apparently, consisting of a congeries of blood vessels, of a grey or cineritious colour; the other firm, white, and composed of minute and delicate fibres: both, however, are essential to the structure of an organ destined to perform specific functions. With it we find two distinct functions united, both dependent on vitality, the nervous and the sensorial power: it is to the first of these that we are accustomed to refer the faculty of transmitting impressions received in one part of the system to other parts; and it is through it, consequently, that the animal is connected with the external world; of which, indeed, we can be conscious only by the diffusion of the impulses received from external objects on particular parts of the frame, to other parts, or to all its parts. Whether this communication is made through the medium of a nervous fluid, or whether it is a mere oscillation, or a property analogous to the galvanic or electrical influence, or whether it is made by any other material agent, we know not: our information extends no farther than the fact, that an impulse communicated to one set of nerves, those of the stomach, for instance, is transmitted to the rest of the body, through the medium of the nerves. There is one curious fact, which would lead us almost to conclude that the transmission of volition, and that of mere impulses neither affording sensation nor connected with volition, depend on distinct circumstances: it is this, that, after the death of an animal, the muscles, which during life are subservient to the will, contract when their nerves are subjected to the galvanic power; but the involuntary muscles cannot in general be thus excited, although, for many hours after death, the heart, which is an involuntary muscle, can be excited

on the contact of a mechanical or chemical agent. In the brain itself the influence of Excitants is manifested by the perceptions becoming more vivid, the imagination more pregnant with ideas, and those of a more brilliant and exalted character: thence the medicines belonging to this class were denominated *exhilarants* by the ancients. Indeed, it is impossible to deny that the employment of stimulating substances, within a certain limit, often produces inspirations and mental sensations. Their influence on the brain becomes most manifest when they are administered in large doses: these being followed by vertigo, temporary delirium, and a change in the perceptions; or, in other words, inebriety. Whether the cerebellum is affected in a manner similar to that of the brain, is uncertain; but there is no doubt that some Excitants affect in a special manner the medulla spinalis, and through it the sensitive nerves of the skin, as is evident when Strychnia is administered. This power, however, of augmenting the general sensibility, is common to all Excitants, although it is possessed in a higher degree by some than by others.

Upon the whole, the influence of Excitants is always more or less perceptible in their effects on the organic functions: on the *digestive function* they are displayed by the food being more quickly and completely digested; on the *circulating*, by the blood being formed in more abundance, more florid, richer in colouring matter, and being moved with more rapidity; on the *respiratory*, by the greater freedom of movement of the thorax, and the glow which pervades its cavity; and on the *secerning*, by the increase both of the secretions and the excretions. The excitement of the brain and the spinal marrow is evidenced by the greater susceptibility to impressions in the nerves of every part of the body; and by a higher degree of intellectual energy, displayed not only in the acuteness of perception, but in the facility of separating and arranging ideas.

Excitants, besides differing in their effects according to the part of the system on which their specific impression is made, differ, also, as far as concerns their degree of force or power. The same Excitant, also, acts differently according as it is combined with different substances. Different Excitants, in different quantities, produce different effects. They vary, also, in the rapidity with which their effects are produced; some being almost instantaneous, others requiring some time; and this altogether independent of the nature of the part to which they are applied. The force or violence of their effects is generally in the ratio of the degree of the rapidity of their action; and the continuance of the impression is, also, in some degree, connected with the same circumstances; since we invariably observe, that the most powerful stimulants, those the action of which is the most rapid, are followed most quickly by a state the opposite of action—that of collapse. This result of Excitants distinguishes

them from some other medicines which also increase action, especially Tonics; but it increases the difficulty of separating them from another class, that of Narcotics, which first quicken action, and soon afterwards exhaust both sensibility and irritability. On this account, we should have as clear conception of what is understood by the term *collapse*, as by the term excitement.

All stimulants, which excite reaction in the nerves, cause an expenditure of power; and the more powerful and longer the excitement is, the greater is the change caused in the nerves: the stimulus may indeed act with such violence as to exhaust the whole vital energy of the organ. Thus, if a motor nerve be excited by long-continued electrical or galvanic action, the contractions in the muscle become more and more feeble until they cease; and they cannot again be excited until the nervous power has been renovated by the nutrient function and time. The degree of the exhaustion is always commensurate with the degree of excitement. Thus Excitants may operate both as vital or vivifying, or as destructive agents: but, in the view which is here required to be taken of the subject, the expressions *excitement* and *collapse* are merely terms relative to some given standard, or to some point which, in the healthy system, can be considered neither that of excitement nor of collapse. With respect to *Excitement*, " if," to borrow the language of Dr. Cullen, " we take the lowest, every higher degree than that must be called a degree of excitement; and, if we take the highest degree, and consider the lower degrees that may take place while life still subsists, every lower may be called a degree of *collapse*." As the terms are meant to be understood in these pages, *Excitement* implies every state of the nervous system in which the energy of the brain is greater than that which, in the waking state of a healthy man, is adequate to the ordinary functions of the system; *Collapse*, that state in which the cerebral energy is so much diminished as to suspend the exercise of the functions of sense and volition—a state of defective activity of the brain, similar to that which causes sleep, only in an augmented degree. There can be no doubt that a certain supply of blood to the brain is essential for the support and continuance of its function: too great an increase of the momentum produces *excitement*; a diminished afflux, on the contrary, within certain limits, or an exhaustion of the moving powers from previous over-exertion, is productive of *collapse*.

From what has been stated, this fact may be collected—that there is a distinction between what are termed purely *vital Excitants* and those which belong exclusively to this order of our arrangement—namely, special Excitants,—which should never be lost sight of. The former, whilst they stimulate, renovate the tissues by entering into their composition, and leave no ex-

haustion after them: the latter have merely a transitory influence, and are more or less followed by exhaustion. The former are, more properly speaking, Tonics than Excitants.

There is, indeed, a distinction between Excitants and Tonics; although this difference is chiefly in degree; but to this distinction I must add, that they differ, also, in the nature of their effects. Excitants increase the mobility of the system; Tonics augment the strength of the muscles: Excitants exhaust the excitability; Tonics, within a certain limit, maintain it: the action of Excitants is immediate, powerful, and transitory; that of Tonics is slow, almost imperceptible, and progressive, but permanent.

With regard to the state of the habit in which Excitants are useful as remedial agents, we may advance this as a general principle—that it is that state in which powerful and sudden impressions on the system are required; in which, from some cause, the functions of the brain and the nervous system are diminished; and in which the impulse of the blood on the brain, necessary for its healthful action, is greatly defective. This condition, is, in truth, one of direct debility of the brain: and that it depends on a deficient impetus of the blood to that organ may be inferred from the fact, that a state closely resembling it is induced by pressure on the carotids; and, when this impetus is excessive, so as to produce convulsions, these are stopped by whatever diminishes the action of the heart, as, for instance, blood-letting; and they have, also, been stopped by compression on one or both carotids. The renewal of this impulse is to be obtained by increasing the general momentum of the blood; and this is most quickly induced by the application of Excitants to the nerves of the stomach, and to those of the Schneiderian membrane, and of other parts on which their influence is direct, and can be immediately impressed. Some objections might be raised against this explanation of the mode in which the increased momentum is said to be produced, by those who contend, and justly so, that the brain exerts very little influence over the action of the heart and arteries; but, when we consider the momentary influence which the passions exert over the heart during perfect health—when we reflect on the magnitude of the cardiac nerves and the sympathy that exists between the heart and other organs in relation to its momentum—we shall have little hesitation in admitting that Excitants, operating on the blood-vessels, produce their effects chiefly through the influence of some portion of the nervous system. The sensible demonstration of the effect of Excitants on the heart and arteries is the increased power and the fulness of the pulse.

Such is the general view necessary to be taken of Excitants in reference to their action on the body in health and in disease;

but, besides these properties, it is necessary that we should have a correct knowledge of the substances that operate as Excitants, in order to understand their utility as Therapeutical agents.

TABLE OF EXCITANTS.

A.—PONDERABLE AGENTS.

ORGANIC SUBSTANCES.*

a.—Volatile Oil—

Uncombined, or as a distinct secretion.

Herb ——	Mentha *piperita.*	14.	1.	Labiatæ.
	——— *viridis.*	—.	–.	———
	——— *pulegium.*	—.	–.	———
	* ——— *citrata.*	—.	–.	———
	Ruta *graveolens.*	10.	1.	Rutaceæ.
Trunk——	* Aloexylon *Agallochum.*	17.	10.	Leguminosæ.
Leaves——	Melaleuca *Cajuputi.*	18.	3.	Myrtaceæ.
	* Andropogon *Calamus aromaticus.*	3.	2.	Graminaceæ.
Flowers —	Citrus *Aurantium.*	18.	2.	Aurantiaceæ.
	—— *Limetta Bergamium.*	—.	–.	———
	Lavandula *vera*	14.	1.	Labiatæ.
	Rosmarinus *officinalis.*	—.	–.	———
	Origanum *vulgare.*	—.	–.	———
Fruit——	* Illicium *anisatum.*	11.	1.	Winteraceæ.
	Carum *Carui.*	5.	2.	Umbelliferæ.
	Pimpinella *Anisum.*	—.	–.	———
	Fœniculum *vulgare.*	—.	–.	———
	* ——— *dulce.*	—.	–.	———
	* ——— *Pammorium.*	—.	–.	———
	Anethum *graveolens.*	—.	–.	———

Combined with Resin, bitter extractive, &c.

Roots——	* Meum *athamanticum.*	5.	2.	Umbelliferæ.
	* Archangelica *officinalis.*	—.	–.	———
	* Peucedanum *montanum.*	—.	–.	———
	* Bergera *Konigii.*	10.	1.	Aurantiaceæ.
	* Chloranthus *officinalis.*	4.	1.	Chloranthaceæ.
	Aristolochia *Serpentaria.*	20.	6.	Aristolochiæ.
	* ——— *rotunda.*	—.	–.	———
	* ——— *clematitis.*	—.	–.	———

* Those plants marked with an asterisk are not in the British Pharmacopœias. The numbers after the name of each plant indicate the class and order in the Linnean System.

Rhizomes	* Alpinea *Galanga.*	1.	1.	Zingiberaceæ.
	Zingiber *officinale.*	—.	—.	———
	Curcuma *longa.*	—.	—.	———
	* ——— *Zedoaria.*	—.	—.	———
	Acorus *Calamus.*	6.	1.	Acoraceæ.
Wood——	Laurus *sassafras.*	9.	1.	Lauraceæ.
Barks ——	Wintera *aromatica.*	11.	1.	Winteraceæ.
	* Illicium *Floridanum.*	—.	—.	———
	* Magnolia *glauca.*	13.	6.	Magnolaceæ.
	* Liriodendron *tulipifera.*	—.	—.	———
	Canella *alba.*	11.	1.	Guttiferæ.
	Croton *Eleuteria.*	21.	8.	Euphorbiaceæ.
	* ——— *pseudo-China.*	—.	—.	———
	Galipea *officinalis.*	5.	1.	Rutaceæ.
	Cinnamomum *Zeylanicum.*	9.	1.	Lauraceæ.
	* ——— *Loureirii.*	—.	—.	———
	* ——— *Culilawan.*	—.	—.	———
	* Dicypellium *caryophyllatum*	—.	—.	———
Leaves—	* Zanthoxylon *fraxineum.*	22.	5.	Zanthoxylaceæ.
	* ——— *alatum.*	—.	—.	———
	* ——— *piperitum.*	—.	—.	———
	* Cinnamomum *nitidum.*	9.	1.	Lauraceæ.
Flowers —	Caryophyllus *aromaticus.*	12.	1.	Myrtaceæ.
	* Calyptranthes *aromatica.*	12.	1.	———
	* Cinnamomum *Loureirii.*	9.	1.	Lauraceæ.
	Crocus *sativus.*	3.	1.	Iridaceæ.
Fruit——	* Ptychotis *Ajowan.*	5.	2.	Umbelliferæ.
	* Sison *Amomum.*	5.	2.	———
	* Anethum *sowa.*	—.	—.	———
	* Smyrnium *Olusatrum.*	—.	—.	———
	Cuminum *Cyminum.*	5.	2.	Umbelliferæ.
	Coriandrum *Sativum.*	—.	—.	———
	Eugenia *Pimenta.*	12.	1.	Myrtaceæ.
	* Myrtus *communis.*	—.	—.	———
	Laurus *nobilis.*	9.	1.	Lauraceæ.
	Piper *Cubeba.*	2.	3.	Piperaceæ.
	* ——— *Caninum.*	—.	—.	———
	* Toddalia *aculeata.*	21.	7.	Xanthoxylaceæ.
	* Coffea *Arabica.*	5.	1.	Cinchonaceæ.
Seeds——	* Monodora *Myristica.*	13.	1.	Annonaceæ.
	Myristica *Moschata.*	22.	8.	Myristaceæ.
	* Iatropha *glauca.*	16.	10.	Euphorbiaceæ.
	* Aydendron *Cujumary.*	9.	1.	Lauraceæ.
	* Strychnos *pseudo-quina.*	5.	1.	Apocynaceæ.
	Elettaria *Cardamomum.*	1.	1.	Zingiberaceæ.
	——— *medium.*	—.	—.	———
	* Amomum *angustifolium*	—.	—.	———

	* Amomum *aromaticum.*	1.	1.	Zingiberaceæ.
	* ——— *grana Paradisi.*	—.	—.	———
	* ——— *grandiflorum.*	—.	—.	———

b.—Camphor—obtained from

Trunk —	Dryabalanops *Camphora.*	13.	1.	Dipteraceæ.
Leaves—	Laurus *Camphora.*	9.	1.	Lauraceæ.

c.—Acrid fixed oil.—contained in

Root —	* Ancyclus *Pyrethrum.*	19.	2.	Asteraceæ.
Fruit—	Capsicum *annuum.*	5.	1.	Solanaceæ.
	* ——— *frutescens.*	—.	—.	———
	Piper *nigrum.*	2.	3.	Piperaceæ.
	* —— *trioicum.*	—.	—.	———
	—— *longum.*	—.	—.	———

d.—Balsam—obtained from

Wood —	Myrospermum *Peruiferum.*	10.	1.	Amyridiaceæ.

e.—Acrid principle—contained in

Root —	Cochlearia *Armoracea.*	15.	2.	Cruciferæ.
	Sinapis *nigra.*	—.	—.	———
	——— *alba.*	—.	—.	———

f.—Alkaloids.

Strychnia and Brucia—obtained from

Seeds —	Strychnos *nux vomica.*	5.	1.	Apocynaceæ.
	* ——— *Ignatia.*	—.	—.	———
	* ——— *ligustrina*	—.	—.	———

Veratria—obtained from

Roots —	Veratrum *album.*	23.	1.	Melanthaceæ.
Seeds —	Veratrum *sabadilla.*	—.	—.	———
	Helonias *officinalis.*	—.	—.	———

g.—Alcohol.

Uncombined.

Pure Alcohol.

Combined.

a. in Ardent spirits.
b. — Medicinal tinctures.
c. — Wines.
d. — Cider.
e. — Beer.
f. — Mead.

h.—Sulphuric Ether.

Uncombined.

Æther rectificatus.

Combined,

with Alcohol.

a. Æther rectificatus cum Alcohole.

INORGANIC SUBSTANCES.

a.—Oxygen Gas.
Uncombined,
in substance.
Combined,
in solution,
a. with Water.
b.—Chlorine Gas.
Combined,
in mixture,
a. with atmospheric air.
in solution,
a. with Water.
c.—Iodine.
Uncombined,
in substance.
Combined,
chemically,
a. with Hydrogen.
b. —— Potassium.
c. —— Sulphur.
d. —— Lead.
e. —— Mercury.
f. —— Arsenic.
g. —— Amidine.
in solution,
a. with Alcohol.
in mixture,
a. with Lard.
d.—Bromine.
Combined,
chemically,
a. with Potassium.
b. —— Iron.
c. —— Mercury.
e.—Gold.
Combined,
chemically,
a. with Chlorine.
b. —— Oxygen.
c. —— Iodine.
d. —— Cyanogen.
f.—Mercury,
I. *combined with Oxygen.*
† *protoxide* prepared by trituration.

a. with saccharine matter.
b. —— unctuous substances.
c. —— Ammoniacum.
d. —— Carbonate of Lime.
e. —— Carbonate of Magnesia.
†† *binoxide* prepared by
the action of Heat and Air.
———— Nitric acid.

II. *oxidized and combined with acids.*
† *protoxide.*
1. with Nitric acid.
2. ——Acetic acid.
3. ——Sulphuric acid.
†† *peroxide.*

III. *combined with Chlorine,*
† *protochloride* prepared by
sublimation.
precipitation.
†† *bichlorde* prepared by
sublimation.

IV. *with Ammonia and Chlorine,* prepared by
precipitation.

V. *with Sulphur:* prepared by
trituration.
sublimation.

VI. *with Cyanogen:* prepared by
decomposition.

VII. *with Iodine:* prepared by
trituration.
decomposition.

g.—AMMONIA.
Combined,
in solution,
a. with Water.
chemically,
a. with Carbonic acid.
b. Hydrochloric acid.

B.—IMPONDERALE AGENTS.

ELECTRICAL AND CALORIFIC POWERS.

a.—ELECTRICITY.
(Galvanism.)

b.—CALORIC—in Hot air baths;
—— water baths;
—— vapour baths;
—— medicated baths.

MECHANICAL INFLUENCES.

Friction.
Percussion.

MENTAL INFLUENCES.

Joy.
Impetuosity.
Hope.

ORGANIC VEGETABLE SUBSTANCES WHICH OPERATE AS EXCITANTS.

VOLATILE OIL. *Oleum volatile.* (Syn. *Etherial oil—Essential oil).*—Volatile oil is secreted by vegetables, and, in many instances, deposited pure in leaves, flowers, and fruits, either in peculiar vesicles on the surface, or in cells in the substance of the vegetable body, or in vittæ in some fruits; in the roots; the rhizomes and bulbs, stem and leaves; fruits and seeds; it is also diffused through the plant in combination with other principles; thence, volatile oils are to be considered either as *uncombined,*—deposited pure in distinct cells; or *combined,* more or less intimately with other principles.

The odour of plants is chiefly owing to the exhalation of these oils. Some plants are odorous under ordinary circumstances, from the spontaneous exhalation of the oil; in others, the cells require to be ruptured, or opened by the drying of the plant, before their odour can be perceived*. The influence of light and heat favours the formation of volatile oils; thence the plants of tropical climates yield them in the greatest abundance. The ultimate components of some of them are Carbon and Hydrogen: some contain also Oxygen, and others Carbon, Hydrogen, Oxygen, Sulphur, and Nitrogen. It is probable that they derive their origin from already elaborated juices.

Every Volatile Oil, whatever may be its consistence, contains two distinct parts: one a volatile, odorous liquid, the *Elaiodon* of Herberger, *Eleoptin* of Berzelius, *Igreusin* or *Hygruzin* of Bizio and Bouillay; the other a concrete, often crystalline, inodorous substance, the *stearopton* of Herberger, stearoptin of Berzelius, and *Stereusin* of Bizio†. The first may be regarded as the Volatile Oil in its extreme purity; the second a substance dissolved in the former, separating by time and rest.

* The odour of new-cut hay, from the drying of the sweet vernal-grass, Anthoxanthum *odoratum,* is an illustration of this fact.

† Journal de Pharm. 1829, p. 167.

I am disposed to believe, with the German chemists, that the solid matter deposited from volatile oils is *Camphor;* or, in some instances, *Benzoic* acid.

The *uncombined* Volatile Oils can readily be procured from the plants in which they are secreted, either by simple expression, or by distillation with water or with watery vapour. The oil and the water pass over together; but after a short time they separate, the oil, according to its density, collecting either on the surface or settling at the bottom of the water. More oil is procured, when the distillation of the fresh plant is commenced with cold water than when boiling water is employed. This is supposed, by M. Dumarest, to depend on the cold water yielding Oxygen to the oil, which is thus rendered insoluble in water. Dried plants yield the greatest quantity of oil. When procured in a separate state, Volatile Oils are of various consistence; some are as liquid as water, and preserve their fluidity at low temperatures; others become concrete; others, again, crystallize by slow evaporation; some always have the vicidity of oil; some the consistence of butter.

The purest Volatile Oils are limpid; indeed, when first drawn, many of them are nearly colourless; and it is probable that the green, blue, and yellow colours, which some of them display, are due to colouring matters not combined with them in the plants, but merely elevated with them in the process of distillation. Their taste is acrid and penetrating; their odour fragrant, but of the most varied description. Some, as those of Cloves, Cinnamon, Pimento, and Sassafras, are heavier than water; those of Lemon, Orange, Lavender, Rosemary, Peppermint, Caraway, and some others, are lighter than that fluid. Those which are the products of plants of temperate climates are the lightest*. Their specific gravity ranges from 0.627 to 1.094†. They are all insoluble in water; although, when agitated or distilled with that fluid, they are suspended in it in minute globules, rendering the water, for some time, milky, and communicating to it their *taste* and *odour*. When triturated with sugar, in the proportion of one drop of the oil to a scruple of sugar, the purest part of the oil is rendered soluble in water; forming what is termed an *Oleo-saccharum*. They are soluble in alcohol, but not all in the same degree: thus, Oil of Turpentine, when mixed with alcohol, separates by rest. They are, also, soluble in Ether, in every proportion; in Naptha and in fixed oils. They readily mix with resins.

When exposed to the atmosphere, at the temperature of from 32° to 212° Fahr. the Volatile Oils yield part of their carbon to the oxygen of the air, forming carbonic acid, whilst they

* M. Brandes ascertained the specific gravity of thirty-one of the light kinds, and found the range to be between 0.8520 and 0.9725.—Archiv. 21, 1827.

† Gmelin.

absorb oxygen, thicken, become deeper coloured than before, and acquire the properties of resinous varnishes. They burn with a bright flame and a black smoke, forming much carbonaceous matter, carbonic acid, and water.

Volatile Oils unite very imperfectly with alkalies and other oxides, forming a species of soapy compound, which the French chemists term Savonules. They are acted upon by the mineral acids, which probably yield Oxygen to them, as they are changed into substances resembling resins. Nitric acid reddens some of the medicinal Volatile Oils; namely, oil of Cloves and of Sassafras: on most of them the strong acids act powerfully, sometimes producing combustion: both oil and acid are decomposed, and carbonic acid, nitrogen, the oxide of nitrogen, sulphurous acid, and aqueous vapour, are evolved, according to circumstances. With Chlorine there is less action; a heavy, white, concrete, oily substance is formed, and hydrochloric acid evolved. This fact has not yet attracted the attention of chemists. I imagine that the oil loses an equivalent of hydrogen, which changes it to the state of a concrete essential oil, whilst the hydrogen, combining with the chlorine, forms the hydrochloric acid. Iodine, when mingled with some of them, causes heat sufficient to volatilize the Iodine: most of them dissolve Iodine: and some of them dissolve Sulphur, forming a deep brown-coloured liquid, termed *Balsam of Sulphur.*

Volatile Oils are frequently adulterated with cheaper volatile oils, alcohol, and fixed oils. The first is detected by the odour, when the suspected oil is dropped on paper and heated: the second by dropping the suspected oil into water; it forms a milky, instead of a transparent film, if impure: and the third by dropping a little of the oil on clean paper, and warming the paper; a greasy spot is left on the paper, if fixed oil be present; if not, the whole of the oil evaporates, leaving the paper clean.

Such are the general physical and chemical properties of the Volatile Oils. The following particulars of the uncombined Volatile Oils, contained in the British Pharmacopœias and employed as Excitants, are necessary to be known.

The natural Order *Umbelliferæ* furnishes the volatile oils of *Caraway, Anise,* and *Dill* seeds, which are lighter than water*. They are obtained from the testæ of the fruit of Carum *Carui,* Pimpinella *Ansium,* and Anethum *graveolens.* In these seeds, the oil is secreted in cells in the upper part of the testa, collected into receptacles termed *vittæ,* marked by longitudinal furrows on the seed, and deposited at the lower part, which sometimes enlarges to a cell. The *oil of Caraway* is of a pale yellow colour, which deepens by time to almost a brown; it has the odour of the plant,

* Ol. Carui, sp. gr. 0.959; Ol. Anisi, sp. gr. 0.979, augmented by age; Ol. Anethi, sp. gr. 0.881.

and a hot, acrid taste. The fruit from which it is distilled is about a quarter of an inch in length, slightly curved, and striated with five ridges, lighter coloured than the seeds. They afford an officinal *spirit**, and a *water*†. The *oil of Anise* is limpid, of a very pale straw colour; has the odour and taste of the fruit, and crystallizes at 50° Fah. in flat plates; but it loses much of its property of concreting when long exposed to the air.‡ Its ultimate components are 76.487 parts of Carbon, 9.352 of Hydrogen, 13.821 of Oxygen, 0.340 of Nitrogen§. The oil of Illicium *Anisatum*, Star Anise, a plant belonging to the N. O. *Winteraceæ*, is sometimes substituted for it; but the distinction is recognized by that oil remaining fluid at 35° 6 Fahr. The fruit of Anise is convex and anteriorly flattish, with many vittæ. They afford an officinal spirit‖. The *Oil of Dill* is of a pale yellow colour, has the odour of the fruit, and a hot, sweetish taste. It readily dissolves in alcohol. Dill is an annual; a native of Spain, Portugal, Austria, and Africa. The fruit is oval, flat on one side, convex on the other, striated with five ridges, and surrounded with a pale margin. It affords an officinal water¶. The seeds yielding these oils are frequently employed in powder, as cardiacs, to expel flatulence; but the oils themselves, in the form of oleo-sacchara, are preferable to the seeds. They are useful adjuncts for correcting the griping properties of some drastic cathartic pills.

The fruit of Fennel, Fœniculum *vulgare*, although mentioned as that employed in medicine, by the London College, is rarely used. The officinal fruit is that of Fœniculum *dulce*. The sweet Fennel is a biennial plant, a native of the South of Europe. The seeds are pale brown, smooth, ovoid, striated longitudinally; they have an acrid, somewhat sweetish taste, and a hot, unpleasant odour—qualities depending on the volatile oil they contain. The oil is nearly colourless, has a hot, sweetish taste, and congeals in a temperature 50° below zero. Its sp. gr. is 0.997**. This oil††, but not that of the wild Fennel‡‡, is officinal; but it is not much used. The water is also officinal.

All of these seeds are sometimes employed in substance.

The natural order *Myrtaceæ* supplies the *Cajuputi oil*, which is obtained from the leaves of Melaleuca *Cajuputi*, an elegant tree, a native of the Moluccas. This oil is deposited in minute cells in the leaves§§. On being bruised, the leaves smell

* Spiritus Carui, L. E. D.; dose, one to two fluid drachms.

† Aqua Carui, L. D.; dose, one to four fluid ounces.

‡ In the chemical action of these oils on the mineral acids, the oil of Caraway differs from the other two in acting most violently on sulphuric acid; both the oil and the acid are decomposed, and much sulphurous acid is evolved.

§ M. Th. de Saussure.

‖ Spiritus Anisi, L.; Spiritus Anisi comp. D.; dose, one to four fluid drachms.

¶ Aqua Anethi, L. E.; dose, one to three fluid ounces.

** Lewis.

†† Oleum Fœniculi, E. D.: dose, m. iii to xx.

‡‡ Aqua Fœniculi, E. D.; dose, one to three fluid ounces.

§§ See Woodville's Med. Bot. 3rd edit. vol. v, p. 57, pl. 15. Rumphius' Herb. Amboin, vol. ii, t. 17. London Dispensatory, art. Melaleuca. Lindley, 73.

strongly of the oil, which is prepared from them by distillation after they are dried.

Cajuputi oil is limpid, and of a beautiful bluish-green colour: its odour is powerful, resembling a mixture of turpentine, camphor, benzoic acid, and cloves: its taste pungent and aromatic. When pure, it rapidly diffuses itself over water, and completely evaporates. Its sp. gr. is 0.914 to 0.980. It dissolves readily in alcohol; burns rapidly when ignited, and leaves no residue. It dissolves Iodine; is acted upon by sulphuric acid at 60° Fahr. and by nitric acid with the aid of heat. The colour is no test of its purity, as the pure rectified oil in India is colourless. It is a compound of 77.92 of Carbon, + 11.69 of Hydrogen, + 10.39 of Oxygen, = 100.00, or C. 10, + H. 9, + O. = 78.20.

This oil is a powerful Excitant: when taken into the stomach, it causes a glow, fills the pulse, and powerfully excites the nervous system; and, from determining to the surface, and equallizing the circulation, it was much prescribed in Asiatic cholera. The dose for internal use is from m. iii to m. x, in the form of an oleo-saccharum. As an external Excitant, diluted with four parts of olive oil, I have found it useful as an embrocation in Phlegmasia dolens, after the active inflammation is subdued; and in chronic Rheumatism.

This natural Order furnishes also the Clove, the fruit of Caryophyllus *aromaticus*, which contains in its cells a volatile oil, which may be obtained by distillation with water. It is of a hot, acrid taste, and has a strong, aromatic odour: when recent, it is nearly colourless, but acquires by age a brownish-red hue. It is heavier than water, but its sp. gr. is uncertain, owing to its being a mixture of heavy and light oil in varying quantities; Lewis states it to be 1.034. A specimen in my possession is 1.065. It is violently acted upon by nitric acid. According to Ettling, it is a compound of 74.6279 Carbon, + 8.1532 Hydrogen, + 17.2189 Oxygen, = 100.0000*.

Oil of Cloves is powerfully excitant. When put into a carious tooth it allays pain by rapidly exhausting the nervous energy. It may be administered as an oleo-saccharum, in doses of from m. i to m. v; but it is seldom prescribed in that form. It is a component of the Pilula Colocynthidis, E.

The Eugenia *Pimenta*, or West Indian Allspice tree, also of this Order, secretes an uncombined volatile oil†, which is procured from the unripe fruit by distillation with water. Like the oil of Cloves, it is a mixture of heavy and light oil: and in many other respects it resembles that oil. It is limpid, of a deep reddish-brown colour, of a sp. gr. 1.060; it has an agreeable odour, not unlike a mixture of the odours of Cinnamon and Cloves.

* Poggendorf, Annal. xxxi, 526.—The light oil is regarded as a compound of C. 10, + H. 8, = 69.20: the heavy, as an acid, a compound of C. 24, + H. 15, + O. 5, = 201.88.

† Oleum Pimentæ, L. E. D.; dose, m. i. to m. iii.

Sulphuric acid and Nitric acid act upon it with violence, both oil and acids being decomposed. It enters into a spirit*, and a water†.

In the natural order *Aurantiaceæ*, we find three medicinal uncombined volatile oils—that of the Orange, Citrus *aurantium*‡; that of the Lemon, Citrus *medica*§; and that of the Bergamot, Citrus *Limetta Bergamium*‖. These oils are best when procured by distillation. That of the Lemon is brought from Portugal and Italy. It is limpid, of a pale straw colour, has the odour of the rind of the fruit, and a hot, acrid, somewhat sweetish taste. It is lighter than water, having a sp. gr. 0.847. The volatile oil of the rind of the sweet and of the bitter Orange closely resembles that of the Lemon. That of the Bergamot is also identical in chemical composition; it has a pale greenish straw-colour, a very agreeable odour, and a pungent, acrid taste. Its sp. gr. is 0.885.

These oils dissolve Iodine readily, forming a deep reddish-brown compound. The oil of Orange-peel scarcely acts upon nitric acid; the oil of Lemon-peel not at all. With hydrochloric acid, both form a kind of paste, made up of white lamellar scales, and a yellow fluid oil: freed from the latter, the crystals sink in water, dissolve in alcohol, and sublime when heated in close tubes; thus resembling, in many respects, the artificial camphor produced by the action of dry hydrochloric acid on oil of turpentine¶. The ultimate components of oil of Lemons are 86.899 of Carbon, 12.326 of Hydrogen, and 0.775 of Nitrogen**: or it may be regarded as a compound of C. 10, + H. 8, = 69.20.

These oils are not much employed as Excitants; their chief use being to cover the odour of the Sulphur and the White Hellebore ointments.

The Order *Rutaceæ* presents us with only one volatile uncombined oil, that of *Rue*††, a secretion of the whole plant of Ruta *graveolens*‡‡. Although this oil is deposited in a pure state in distinct cells in the leaves and the sepals of the flowers of the plant, yet, in other parts of the plant, it is in combination with reisn. The Oil of Rue has a strong, unpleasant odour, and a hot, biting taste. The colour of the fresh-drawn oil is pale greenish-yellow; but this deepens by age; and a deposit resembling resin gradually takes place, without injuring the properties of the oil. Its specific gravity is 0.911. This oil dissolves Iodine readily;

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* Spiritus Pimentæ, L. E. D.; dose, two to four fluid drachms.

† Aqua Pimentæ, L. E. D.; dose, one to three fluid ounces.

‡ Woodville's Med. Bot. 3rd. ed. p. 523, pl. 188. London Dispensatory, art. Citrus. Lindley's Flora Med. 163.

§ Woodville, p. 528, pl. 187. Lindley, 164.

‖ Lindley, 163.

¶ The crystalline matter has been named *Citronyde*, and is a compound of C. 10, + H. 8, + H. Chl.; the fluid, *Cithyle*, by Blanchet and Sell.

** M. de Saussure.

†† Oleum Rutæ, D. E.

‡‡ Woodville, p. 487. pl. 184. London Dispensatory, art. Ruta. Lindley, 210.

is rapidly decomposed by sulphuric acid; but acts on nitric acid very feebly. It congeals at 40° Fahrenheit.

The whole of the plant of Rue is employed on the Continent as an Excitant, in the forms of powder, decoction, and extract: but the oil is generally used in this country; and, when triturated with mucilage, or with sugar as an oleum-saccharum, it is preferable to the plant. In the latter form, it may be administered in doses of from m. ii to m. v, at moderate intervals. The Dublin Pharmacopœias contain an aqueous extract; but, as the oil is dissipated during its preparation, it possesses no excitant properties. The *Confection*, the properties of which depend on the volatile oil, shall be afterwards noticed.

Oil of Rue excites powerfully the whole of the nervous system. The plant itself is extremely acrid in the fresh state; it was prescribed by Hippocrates*, after being dried, in chlorosis, hysteria, and other diseases of females connected with a low state of the nervous energy; and it was equally prized by Boerhaave in the Neuroses: but it requires to be cautiously administered to pregnant women. It has been externally applied as a Rubefacient in palsy, and in colic.

The Order *Labiatæ* contains more plants secreting uncombined oil than any other order. All the parts of these plants are studded with vesicular glands filled with volatile oil. The quantity formed by the plants depends much on the state of the atmosphere: when the air is dry and the temperature considerable, the secretion proceeds with great activity; when it is moist and the season wet, the quantity of oil is small. Thence, within the tropics, the plants belonging to this order yield, not only Volatile Oil of a better description, but also in greater quantity than those in the temperate zones. These oils, when kept, deposite more stearoptin than any of the other volatile oils.

When the Labiated plants are carefully dried, and the vesicles not ruptured, they retain all their properties in perfection; in fact, they become more active from losing their moisture.

The *Oil of Lavender—Oleum Lavendulæ*, L. E. D.—is erroneously stated in the London and Dublin Pharmacopœias to be the produce of the Lavandula *spica*†: it is that of the *Lavandula vera*. E‡. The odour of this oil is most agreeable; the taste, like that of all volatile oils, is hot and biting. When newly distilled, it is nearly colourless; but it gradually acquires a lemon-yellow hue, and a sp. gr. 0.877 to 0.905. It is obtained chiefly by distillation with water from the flowers; for when the leaves and stalks are used, the oil is of an inferior quality§. It dissolves Iodine rapidly; producing a perceptible increase of temperature,

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* Under the name Πήγανον.

† Woodville's Med. Botany, third ed. p. 221, plate 114 London Dispensatory, art. Lavandula. Lindley, 486.

‡ Lindley, 485. § Brande.

and slight explosions. Sulphuric acid decomposes it instantly; but the nitric does not act upon it for some time, unless mixed with the sulphuric acid, or with alcohol; in which case the action is violent. From these facts, the impropriety of ordering Tincture of Lavender in combination with sulphuric acid, or nitric acid, in the form of drops, is obvious. This oil dissolves in concentrated acetic acid; but it separates again when the solution is diluted with water. Its ultimate components are 75.50 of carbon, 11.07 of hydrogen, 13.07 of oxygen, and 0.36 of nitrogen*: or, according to Mr. Kane, of C. 12, + H. 10, + O. = 91.44.

This oil is a powerful and frequently-employed Excitant. It is administered in doses of m. i. to m. v, in the form of an oleosaccharum, and in combinations with spirit†, formerly the powdered flowers were used as an Errhine in cephalalgia. They still form an ingredient of the compound powder of Asarabacca. (See Errhines.)

Four species of the Genus Mentha yield volatile oils; namely, the *Viridis*, *Piperita*, *Pulegium*, and *Citrata*‡; but the three former only are noticed in the British Pharmacopœias. All the plants of this Genus so closely resemble one another, that it is difficult to distinguish them, unless we have recourse to the characteristics pointed out by the late Sir E. Smith: the hairs on the pedicils, and those of the bractes and the sepals. Thus, Spear Mint, Mentha *viridis*, besides being distinguished by the loose, nearly cylindrical, uninterrupted floral spikes, has the bractes and calcycinal teeth furnished with stiff hairs, or setæ: the Peppermint, Mentha *piperita*, has lax, obtuse spikes, interrupted in the lower part; but the chief characteristic is the smooth, naked, calyx, the teeth only being furnished with dark purple hairs; in the Penny Royal, Mentha *Pulegium*, the flowers are in remote whorls, and the pedicils and the sepals are every where covered with down. All these species yield, by distillation with water, a considerable quantity of volatile oil§. They differ very little from one another, either in their physical or chemical properties, or in their effects on the animal œconomy: consequently, they may be indiscriminately used. The *Oil of Spearmint, Oleum Mentha viridis*, L. E. D. is of a pale yellow colour, is lighter than water, and has the odour and the taste of the plant in an eminent degree. It is a compound of C. 35,+H. 28,+O.= 250.20‖. The dose is m. i. to m. v. The *Oil of Peppermint—Oleum Menthæ piperitæ*, L. E. D.—is, when recent, of a pale yellow or green colour; but it acquires a reddish tinge by age: it is

* M Th. de Saussure.

† Spiritus Lavandulæ, L. E. D Dose, one to four drachms.

——— comp. E D. Tinctura Lavandulæ composita. L. Dose, half a drachm to two drachms.

‡ Woodville, pp. 336, 338, 342. Dispensatory, art. Mentha. Lindley, 486, 7, 8.

§ The English oil of Peppermint is preferred to all other, even on the Continent.

‖ Mr. Kane. ¶ Ibid.

lighter than water, has a hot, penetrating odour, and leaves on the palate an agreeable sensation of coolness. Its sp. gr. is 0.902. Its ultimate components are C. 25, + H. 22, + O. 2 = 190.90*.—The dose is m. i. to m. iii. The *Oil of Penny Royal—Oleum Menthæ Pulegii*, L. E. D.—is of a pale straw colour, and has the peculiar odour and the warm taste of the plant. According to Mr. Kane, it approaches the Terebinthinate oils, or rather Camphor, in its ultimate components, which are C. 10, + H. 8, = 69.20. The dose is m. i. to m. v.

These oils are all ready solvents of Iodine, and are decomposed by, and decompose, both the sulphuric and the nitric acid. M. Dublanc, by exposing oil of Peppermint to a temperature of 8° to 12° below 0, centigrade, obtained crystals of a tetrahedral form, which separated and left a thin fluid oil. These crystals are soluble in alcohol and ether, and taste acrid and rancid. Aqueous infusions† of the plants, and waters‡ distilled from them, owe their properties to the oils; they are employed in anorexia and weakened states of the digestive organs; and occasionally the plants themselves are used in the form of powder. These oils, rubbed up with sugar, or with mucilage, may be advantageously administered in cases of cramp of the stomach, flatulent colic, and other conditions of the digestive organ depending on a weakened state of its nerves. The pharmaceutical preparations of the plants, besides the infusions and distilled waters, are spirits§; the medicinal properties of all of which depend on the presence of the volatile oil of the plant in them.

In the same order, *Labiatæ*, we find the Origanum *vulgare* and *marjorana*‖; both of which yield volatile oils of a reddish-colour, and an acrid, bitter taste: but that of sweet Marjorum is not officinal. *Oil of Common Marjorum, Oleum Origani*, L. E. D. dissolve Iodine rapidly, and is instantaneously decomposed by, and decomposes, sulphuric acid, whilst much sulphuric acid is evolved. It acts also upon nitric acid with violence, after it has remained for half a minute in mixture and assumed a dark colour. When long kept, it deposites white diaphanous crystals. According to Mr Kane, its ultimate components are C. 50, + H. 40, + O. = 354.00. The oil of Origanum is chiefly used as a local stimulant in toothache, rheumatism, and other diseases attended with pain: it is too acrid for internal administration. An infusion

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* Mr. Kane.

† Infusum Menthæ, D. Dose, one to three fluid ounces, or more.
——— Menthæ comp. D. Dose, one to two fluid ounces.

‡ Aqua Menthæ viridis, L. E. D. Aquæ Menthæ piperitæ, L. E. D. Aqua Menthæ Pulegii, L. E. D. Dose, one to three fluid ounces. They are apt to mould; but, when redistilled, they keep well in close vessels.

§ Spiritus Menthæ viridis, L. D. Spiritus Menthæ piperitæ, L. D.—Spiritus Menthæ, E. Spiritus Menthæ Pulegii, L. E. D. Dose, half a drachm to three fluid drachms.

‖ Woodville's Med. Bot. third ed. p. 344, pl. 123, 124. London Dispensatory, art. Origanum.—Lindley, 490.

of the herb is also sometimes used in chronic bronchitis and old asthmas.

Oil of Rosemary is a very powerful uncombined volatile oil, contained in the petals of Rosmarinus *officinalis**, another plant of this order. This oil has a penetrating, unpleasant odour, with a hot, acrid taste. Its specific gravity is 0.85. It differs in its chemical properties from the other volatile oils of this order, by the slight influence which it exerts upon the sulphuric and nitric acids. When kept for some time, it deposites much Stearoptin. The ultimate components of this oil are 82.81 of Carbon, 9.42 of Hydrogen, 7.73 of Oxygen, and 0.64 of Nitrogen†; or, according to Mr. Kane, of C. 40, + H. 36, + O. 2, = 298.80. It is often adulterated with oil of Turpentine. The powdered plant is employed in the composition of cephalic snuffs. On the Continent, an infusion of Rosemary is administered to awaken appetite and augment the digestive powers of the stomach. The dose of the volatile oil, if internally employed, is m. ii to m v. The best form of administration is that of an oleum-saccharum. It affords a spirit‡, and enters into some officinal preparations§.

All these volatile oils operate as direct Excitants, in as much as their primary influence is exerted on the stomach; but, in almost every instance, the effect produced is extended by the nerves to the whole system. Volatile oils, however, are also taken into the circulation, and, pervading the system, shew themselves in some one or more of the excretions. The medicinal use of Volatile Oils is of a very ancient date; for, although they were not obtained by distillation in the time of the Coan Sage, yet, they were procured by the trituration of the plants and flowers yielding them with fixed oil. From the antiseptic qualities and the agreeable odour of many of them, they were early employed in embalming the dead, and for the preservation of animal matter from putrefaction.

Applied to the living system, these Volatile Oils are powerfully stimulant to the skin; their application produces local inflammation. When taken into the stomach, the primary excitement is propagated over the whole system. When the dose is large, intense inflammation of the stomach is induced, and it may be followed by gangrene and death; but, when it is small, and its acrimony is sheathed by other substances, as with fecula, which occurs in the seeds of the umbelliferæ, the stimulus is beneficial; promoting digestion, and giving vigour to the habit, partly through the medium of the stomach, partly by being absorbed into the blood, exciting the action of the heart and ar-

* Woodville's Med. Bot. 3rd edit. p. 39, pl. 117. London Dispensatory, art. Rosmarinus. Lindley, 489. † M. de Saussure.

‡ Spiritus Rosmarini, L. E. D. Dose, half a fluid drachm to two fluid drachms.

§ Linimentum Saponis—Tinct. Lavandula composita.

teries, and thence promoting the excretions of the skin and the kidneys. Although they are all more or less general Excitants, yet, their action, in some instances, is chiefly exerted on particular organs. Thus, the oil of Juniper will be found among the Diuretics; that of Savine among the Emmenagogues.

Volatile oil is often the active principle of vegetable medicines; but, it is so variously combined, that it is frequently difficult to determine its share in the excitant property of the remedy. In its separate state, it is so powerfully stimulant, that it is never administered alone, or undiluted with mucilage or some bland emulsion which can sheath its acrimony. Besides being employed as an Excitant, it is used to correct the griping property of resinous cathartics, by affording a fresh stimulus which exhausts the excitability of the nerves on which the griping property of the resin acts; and, on the same principle, a drop introduced into a hollow tooth relieves toothache. In languid and sinking states of the system, the Volatile Oils may be advantageously administered in the form of oleo-sacchara. The more acrid of them are employed externally as embrocations in paralytic affections and deep-seated pains*.

Having examined the uncombined medicinal Volatile Oils, we have next to enquire into the nature of those volatile oils which exist in plants in combination with other principles; namely, gum, fecula, bitter extractive, resin, fixed oils, and a few other principles peculiar to certain plants. In these combinations, the volatile oils are found in combination with the resin, forming oleo-resins, constituting, with the bitter extractive, the active medicinal agents of many roots, wood, bark, leaves, flowers and fruit.

OLEO-RESINS.

In the living plants these are semi-fluid secretions, deposited in various parts of the plants; in some instances exuding spontaneously, in others flowing from incisions. They are usually odorous, owing to the volatile oil which they contain, and which is readily separated by distillation with water. Their taste is hot and acrid. The oleo-resins all operate as powerful Excitants, topically upon the part to which they are applied; and also upon particular organs, and the system generally, after they are absorbed. When long used, and on some habits, they cause eczematous eruptions on the skin; and, in large doses, great depression of the nervous system.

* Besides the plants already mentioned, volatile oil is also secreted in the Aloexylon *Agallochum*, a Leguminous plant, as a concrete oil; which is used by the oriental doctors in Vertigo and Paralysis: and in the leaves of Andropogon *Calamus aromaticus*, an Indian grass. The volatile oil of the latter is known as the Grass Oil of Namur, and resembles Cajuputi Oil in its physiological action.

* *Roots and their Appendages, containing Oleo-resins.*

SERPENTARIA ROOT. *Serpentaria Radix.* L. E. D.—Serpentaria is the root of Aristolochia *Serpentaria**, a low, slender, perennial plant, belonging to the Natural Order *Aristolochiaceæ,* a native of North America, particularly Virginia, whence the name *Virginian Snake Root.* Each root consists of a small gibbous body, or caudex, from which numerous fibrous radicles proceed, of a brownish colour in their dried state. The plant seldom rises more than eight or ten inches in height: the stem is slender and flexuous, furnished with alternate heart-shaped acuminate, entire leaves, slightly ciliated. The flowers are small, of a purple colour, and situated on long pedicils at the lower part of the stem, distant from the leaves†.

This little plant is generally found growing in thick woods on the shady side of mountains, from New England to Carolina. The dried roots are imported to Europe in bales. As imported, they are sometimes mingled with the roots of the Asarum *virginicum,* readily distinguished by their black colour and defect of aromatic odour‡. The greatest part of the caudex consists of fecula; consequently this part is much less active than the radicles, and ought to be rejected. The odour of Snake-root is aromatic, resembling that of Valerian and Camphor: it has a warm, bitter, terebinthinate taste, not easily concealed by any admixture. It owes its odour to a volatile oil, which rises in the distillation of the root with water, and renders slightly turbid the tincture on the addition of water; its bitterness is due to a bitter principle closely resembling Quassina, at least as far as can be determined by tests: diacetate of lead and nitrate of silver being the only substances which precipitate the infusion.

Serpentaria has been examined by Chevalier and by Bucholz. According to the latter, it consists of volatile oil 0.50, greenish-yellow resin 2.85, bitter extractive 1.70, gummy extract 18.10, ligneous fibre 64.40, water 14.45, = 100.00. It also contains a free acid, the nature of which I have not determined. The volatile oil is closely combined with the resin. It is a powerful Excitant, acting on the vascular and the cuticular

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* The genus Aristolochia contains species with flowers of the greatest diversity in point of size. One species, growing on the borders of Madalena, is so large that they serve as bonnets for children.

† Barton's Veg. Mat. Med. of the United States, plate 28, page 41. Woodville's Med. Bot. 3rd edit p. 153, fig. bad. London Dispensatory, art. Aristolochia. Lindley, 341.

‡ The root of the officinal species was brought into notice, in Europe, in 1633, by Mr. Thomas Johnson, of London; and, in 1635, a pamphlet, published in Paris by Dr. Cornutus, recommended it as an effectual remedy for the bites of snakes; thence its specific name, Serpentaria. The generic name is derived from two Greek words, αριστοσ and λοχια, from some supposed use of several of the species in cleansing the lochia after parturition; and thence, also, the English name *Birthwort.*

systems; thence it is indicated when the powers of life are languishing, and the skin is hot and dry. If the surface be kept warm, it rarely fails to excite the action of the capillaries of the skin; determining to the surface, at the same time that it supports the powers of life. When the surface is kept cool, it operates on the kidneys.

From its stimulant nature, it is contraindicated in states of the habit requiring the use of the lancet; and also if any acute or subacute inflammation exists in the digestive organs. In large doses—℈iss to ℈iii—it excites nausea, vomiting, colic, and tenesmus, and its influence extends to the brain, causing a sensation of pain there. The form of preparation commonly employed is Infusion, made of various strength according to circumstances: perhaps the best proportions are ℥ss of the bruised root to f℥xii of water. The Pharmacopœias order ℥ss to Oi of boiling water. Of this infusion, f℥iss may be given for a dose. In full doses, its effects last twenty-four hours; in small, twelve hours.

Another species of Aristolochia, the A. *rotunda*, was an ingredient in the celebrated Portland powders, an obsolete remedy for the gout, which Parliament bought from the proprietor. Cullen affirms that this species of Aristolochia has the power of preventing attacks of gout when it is taken daily for some time: but that it causes dyspepsia and hypochondriasis!

As a local Excitant, Serpentaria has, also, been found useful in gangrenous sores; and, in the form of a gargle, in ulcerated throats, in which case I have generally combined it with tincture of capsicum.

* * *Rhizomes containing Oleo-resin.*

GINGER. *Zingiber.* L. E. *Amomum Zingiber. Radix.* D. This substance is a rhizome, which contains volatile oil combined with fecula. It is a reservoir of nutriment for the future plants of the Zingiber *officinale*, which belongs to the natural order *Zingiberaceæ*. It is a native of the mountains of Gingi, in Hindostan, whence its name is derived*. It was carried from India to Cayenne, and to the West Indies, where the greater part of the Ginger used in Europe is cultivated.

The *rhizomes*, the parts medicinally employed, are attached to the base of the plant. They are perennial, palmated or knotted, flat, fleshy, and greenish within, but becoming fibrous and pale yellow with age; they are covered with a wrinkled, purplish brown epidermis, and marked with scarcely perceptible circles†. In the dry state, *White* Ginger, which is chiefly

* Dioscorides (lib. ii, c. 190) and Pliny (Hist. Nat. lib. xii) notice it.

† For the botanical characters of the plant, see Woodville's Med. Bot. p. 731, pl. 250, 3rd. edit. Jacquin Hort. Vindob. vol. i, p. 76; Lindley, 559: and for the method of preparing the Ginger, see London Dispensatory, art. Zingiber.

brought from *Jamaica*, is nearly white on the exterior, long, and more or less knotted; it breaks with a fibrous fracture, and has a whitish-yellow tinge within, and produces a bright straw-coloured powder. The *Black* or common Ginger is in shorter pieces, and covered with a cuticle of a dirty grey colour: it comes from *Barbadoes*. A grey Ginger is also brought from *Africa:* it is small and partially scraped. On the other hand, the *East Indian* and Tellicherry Ginger is large, and has a reddish epidermis. The greatest quantity of Ginger imported is the produce of our West Indian colonies.

The Ginger is dug up in January, after the stems, which are annual, have withered: the best pieces are selected, scraped, separately washed, and dried in the sun, for making what is termed *white Ginger:* but they are simply scalded before being dried, to constitute *black Ginger*. The difference consists in the higher flavour and greater pungency of the white Ginger. Soundness or freedom from worm-holes, compactness and weight, constitute the goodness of both kinds.

Ginger has an aromatic, pungent odour, and a hot, biting, acrid taste. Alcohol and ether extract its efficient principle, which is an acrid oleo-resin, lighter than water; it is united with fecula, which constitutes the greater part of the Ginger. This oleo-resin can be obtained by distilling the alcoholic tincture of Ginger; the residue is this substance.

The volatile oil, which is of a bluish-green colour, is obtained in small quantity by distilling the bruised rhizomes with water: its taste is at first not pungent; but it soon becomes so in the mouth. When the oleo-resin is removed, the fecula is nearly insipid*.

According to the analysis of M. Morin, Ginger contains—1, a resinous matter, soluble in ether; 2, a sub-resin, insoluble in ether; 3, a bluish-green volatile oil, lighter than water, and extremely acrid; 4, free acetic acid; 5, Acetate of Potassa; 6, Osmazome; 7, Gum; 8, a vegeto-animal matter and mineral salts; and 9, a large proportion of fecula, some sulphur, oxides, and lignine†.

Ginger acts powerfully upon the mucous membrane, in whatever manner it is applied to it. It also acts on the salivary glands when chewed, causing an abundant flow of saliva. In a moderate dose, it is an useful general Excitant in flatulent colic, dyspepsia, and gout in the stomach; but it requires to be employed with caution, particularly by those who have any tendency to stricture of the uthera, as it excites the genital organs. It rouses, generally, the nervous energy; but I cannot accord with those who assert that it improves the sight, strengthens the memory, and elevates the moral faculties. It is a useful addition

* M. Planché says the starch is as pure and bland as that obtained from wheat.
† Journ. de Pharm. Juin 1823.

to griping purgatives, rendering them less likely to irritate the nerves of the intestinal canal: it also appears to rouse the vitality of the intestinal surface, and to render it more susceptible of the influence of cathartic substances. The dose of ginger, in the form of powder, is from gr. x to ℈i: but, from habit, much greater quantities are daily taken as a condiment. It forms one of the numerous ingredients of the ancient Mithridate; and enters into a few modern officinal preparations*.

TURMERIC—*Curcuma*, L. D. —*Circuma longa.*—*Radix*, D. is in the same order.—This plant, Curcuma *longa*, is a native of India, and extensively cultivated there. The roots proceed from tubers, which owe any medicinal properties they possess to the combination of a volatile oil with fecula. They are oblong, whitish, knotted, and about the thickness of the finger, with some fleshy fibres attached to them. They are heavy, break with a waxy fracture, and display internally a deep yellow colour marked with shining points. According to an analysis of Vogel, Pelletier, and Caventou, they consist of—1, a brown colouring matter, resembling extractive; 2, a small quantity of Gum; 3, an odorous, very acrid volatile oil; 4, a yellow colouring matter, *Curcumin;* 5, some chloride of Calcium; 6, Fecula and Lignine‡.

The dried tubers are brownish, externally wrinkled, of a golden-yellow or saffron colour; in odour not unlike ginger; in taste acrid, aromatic, and slightly bitter: they tinge the saliva yellow. The yellow colouring matter, Curcumin, resembles resin; when pulverized, it is heavier than water, in which it is sparingly soluble; it is very soluble in acohol, in ether, and in both fixed and volatile oils; it is tasteless and inodorous; the alkalies deepen it to a dark red-brown; thence paper, tinted with Turmeric, is used as a test of the presence of alkalies.

Turmeric was at one time employed as a stimulant to the uterus, in defective or obstructive menstruation; and in hepatic diseases; but its use has now become almost obsolete. As an Excitant, it sharpens the appetite and aids the digestive process, quickens the pulse, and elevates the temperature of the body.

RHIZOME OF SWEET-FLAG. *Acorus*, L. *Acori Calami radix.* E.—Syn. *Calamus Aromaticus.*—This substance is improperly

* Tincturæ Zingiberis, L.E.D.; dose, one to two fluid drachms. Syrupus Zingiberis, L.E.D.; dose ad libitum.

† For a botanical description of the plant, see Woodville's Med. Bot. p. 737 to 252, 3rd edition. Jacquin Hort. Vindob. tome iii, p. 5, tab. 4. London Dispensatory, art. Curcuma. Lindley, 562. Its name is derived from the Persian name for Saffron.

‡ Journ. de Pharm. 1826, p. 289. John also analysed Curcuma, and obtained—a volatile oil, 1 part; yellow resin, 11 parts; yellow extractive, 12; gum, 14; lignine mixed with a matter soluble in potassa, 57; water, 5; = 100.

termed a root, in the Edinburgh Pharmacopœia; it is a *rhizome*, or rootstock, emitting roots or radicles. This rhizome is the active part: in it, volatile oil is combined with resin, fecula, inulin*, and gum. The plant to which this rhizome belongs, the Acorus *Calamus*, is an indigenous aquatic, belonging to the natural order *Acoraceæ*†. It is found in many parts of Europe, in India, and Japan; and grows abundantly in shallow pools and on the banks of rivers in England. The rhizome is about half an inch to an inch in thickness, flat, jointed, and of various lengths. The joints are nearly an inch in length, and send off from their lower surface whitish-yellow rootlets, and also from the upper part bunches of brown, hair-like fibres, when the plant has grown in its natural marshy situation. The leaves of the plant, which are ensiform and waved on one margin, are, when bruised, as aromatic as the rhizomes. The latter should be gathered late in autumn.

The dried rhizome is covered with a corrugated cuticle, of a brownish-yellow colour, marked with many white elevated spots, whence the radicle fibres issue. It breaks with a hackly fracture, displaying a pale pinkish-white interior, tinged on the outer part with shades of rose-red and bistre; it exhales an agreeable aromatic odour, and has a warm, pungent taste, not unlike that of Camphor, becoming bitter and nauseous when much chewed. The smell and taste are improved by drying. The aromatic principle is an oleo-resin; the volatile oil of which can be separated by distillation; it differs from most of the other volatile oils in some particulars: it does not dissolve iodine; it instantly decomposes sulphuric acid, but is slowly acted on by the nitric acid. It is lighter than water, of a pale yellow colour, and possesses the odour and pungency of the plant: it is combined with resin, inulin, and vegetable mucilage, detected by diacetate of lead. When alcohol is digested on the pulverized rhizome, a resinous extract is procured on evaporating the tincture.

The Rhizome of Acorus *Calamus* is an excellent Excitant in colic, in the flatulence of dyspepsia, and in the low sinking stage of malignant fevers; and, from my own experience, I know that it is one of the best additions to Cinchona and disulphate of Quina in intermittents. It has been used alone, successfully, in Norfolk, in curing ague. The volatile oil is the active principle; but, in its primary or topical action, the resin and bitter extractive aids the effect produced on the stomach itself. The

* This principle has much resemblance to starch; from which, however, it is distinguished by being deposited as its solution in hot water cools, and in striking with Iodine a greenish-yellow instead of a blue colour. It is distinguished from gum by its insolubility in cold water, and by not yielding saccholactic acid when digested in nitric acid.

† Barton, Veg. Mat. Med. vol. ii, pl. 30, p. 65. Woodville's Med. Bot. vol. iv, pl. 248, p. 725, 3rd. edit. London Dispensatory, art. Acorus. Lindley, 606.

oil enters the circulation and operates chiefly on the kidneys, in the secretion of which it is readily detected by its odour. It is an excellent medicine in those cases of dyspepsia in which vertigo, arising from flatulence, is one of the symptoms: but, like many other valuable native remedies, it is much neglected. Dr. Paris mentions that it is so favourite a remedy with the native practitioners of India, in bowel complaints, that a penalty is incurred by any druggist who refuses, in the middle of the night, to open his door and to sell the Acorus-root, if demanded. This is true; but the Indian Acorus is not our plant*.

Calamus aromaticus is advantageously administered in the form of powder; decoction destroys its efficacious properties by dissipating the volatile oil; an infusion does not take up the whole of the oil. The dose of the powder is from ℈i to ʒi. It is usefully combined with magnesia and chalk, in the flatulent colic of infants†. The volatile oil may be given as an oleum-saccharum in combination with disulphate of Quina, the anti-periodic effect of which it greatly improves. The dose of the oil is from m. ii to m vi.

* * * *Woods.*

SASSAFRAS. *Sassafras.* L. E.—*Lignum, Radix, Oleum Volatile.* D.—Sassafras is the wood of the Laurus *Sassafras,* or Sassafras *officinale,* a plant belonging to the natural order *Lauraceæ.* It is one of those plants in which the volatile oil, to which it owes its medicinal properties, although in combination, yet is so abundantly secreted as to render the roots, the wood, and the bark officinal. It is a native of North and South America‡; a handsome tree, rising about forty feet in height, with large alternate leaves, varying in form, some oval, nearly obtuse, narrowed at the base, entire, with reticulated nerves; others trilobed, almost cordiform, with two or three longitudinal nerves§. The wood is imported in junks of different sizes, in general about the thickness of the arm of a man, covered with a rust-coloured, spongy, highly aromatic bark. The wood of the root is more aromatic than that of the stem. It has a brownish-yellow colour, veined with brown. The odour is powerful, not unlike that of Fennel; the taste, aromatic, sweetish, and slightly

* The κάλαμος ἀρωματικὸς of Dioscorides was the Andropogon *Calamus aromaticus* of the Hindoos, which yields the Oil of Grass.—*Royle.*

† A Tincture, made with two ounces of the bruised rhizome and twelve ounces of proof spirit, is much used on the Continent.

‡ It was discovered by the Spaniards after their conquest of Florida under Ferdinand de Soto, 1538.—Savary's Dictionary, vol. ii, p. 487. The Spaniards called it Cinnamon tree; the Indians Pavamé. The name Sassafras was imposed by the French, who first brought it to Europe. Alston, Mat. Med. ii, p. 51.

§ For the botanical characters, see Woodville's Medical Botany, p. 674, pl. 234, 3rd edition. London Dispensatory, art. Laurus. Lindley, 338.

acrid. The volatile oil, which can be separated by distillation with water, is so abundant that six pounds of the rasped wood yield two ounces of the oil. It is colourless when newly drawn, but acquires a deep yellow, almost red colour by age. It is heavier than water, sp. gr. 1.08 to 1.09, and is violently acted upon by nitric acid; is tinged red, and yields oxalic acid. When long kept, this oil deposites stearoptine in large crystals. Boiling water extracts partially the properties of the bark and wood of Sassafras; alcohol completely; and by distilling the tincture, an oleo-resinous extract remains, possessing all the active virtues of the Sassafras.

The exciting power of Sassafras seems to be exerted chiefly on the capillaries; causing either sweating or a flow of urine, according as the surface is kept warm or cool. When the skin fails to be affected, it excites febrile symptoms. At one time the bark and the wood were highly extolled; and, whether given in the form of an infusion or in any other form, they were regarded as specifics in rheumatism and gout. Their fame was also great as antisyphilitics. To those who may still wish to try their effects in syphilis, it should be known that bichloride of mercury is incompatible with the infusion which it precipitates; neither can the infusion be given in combination with salts of Iron. But, although Sassafras and its preparations are certainly Excitants of some power, stimulating the capillaries and invigorating the general habit, yet, they have fallen into disrepute, and are now employed almost solely as domestic medicines, in Acné and similar cutaneous eruptions—a relic of the humoral school, the sole remnant of the doctrine of sweetening the blood. It enters as a component into the compound decoction of Sarsaparilla, and of Guaiacum.

* * * * *Barks.*

WINTER'S BARK.—*Drymis Aromatica—Cortex.* D.—A valuable combination of volatile oil with resin is found in the bark of the Drymis *Aromatica* or *Winteri*, the true Winter's Bark. The tree which yields this bark belongs to the natural order *Winteraceæ*: it grows in the straights of Magellan, where it was discovered by Captain Winter in 1579, and thence received his name*.

The true Winter's Bark is usually in slightly quilled pieces, about eight or ten inches in length, and from one to two inches in breadth, and not more than one fourth of an inch in thickness. It is wrinkled on the exterior, is of a reddish-grey colour, and spotted with elliptical red blotches: interiorly, it is of a dark-brown cinnamon-hue. It breaks with a compact fracture, which

* For the botanical characters of the tree, see Woodville's Med. Bot. p. 647, pl. 266. London Dispensatory, art. Wintera. Medical Obs. and Inquiries, vol. v. Richard, Hist. Nat. Med. tome ii, p. 605. Lindley, 26.

is grey on the outside and reddish within; these two colours being separated by a very sensible line of demarkation. Its odour is fragrant, augmented in the powder; its taste acrid and peppery; both depending on a volatile oil and an acrid resin. Besides these two principles, M. Henry has discovered in it a *colouring matter, tannic acid,* the *acetate, hydro-chlorate,* and *sulphate of potassa, malate of lime,* and *oxide of iron.* The oxide of iron and the tannic acid distinguish its infusion from that of Canella bark, and are easily detected; the oxide by ferrocyanate of potassa, the acid by persulphate of iron and gelatine. On account of the sulphate of potassa, the infusion is precipitated by the salts of baryta.

Winter's Bark imparts its properties to boiling water, and may be administered in the form of infusion. Decoction is a bad form of preparation. It is given also in the simple state in powder, in doses of from gr. vi to ℈i: on the Continent, a wine and tincture of this bark are much employed. It acts as a simple but powerful Excitant, exerting its primary influence on the nerves of the stomach: but, like all the other vegetable Excitants, its active principle is taken into the circulation and imparts its odour to the urine. Captain Winter, who first brought it into notice, used it as a condiment in seasoning the food of his sailors, who were suffering under the ravages of scurvy; he also applied the leaves of the tree, in the form of fomentations, to their sores. Under this treatment they got well; but, as Murray justly remarks—"Nec ullam prœrogativam præ aliis aromaticis huic concidere possum sub eo morbi gradu eaque conditione, qua aromata conferre possunt *." Winter's Bark is, nevertheless, a valuable Excitant; and, in diarrhœas depending on a low condition of the habit, with deficient cutaneous action, the combination of the tannic acid and volatile oil gives it an advantage over Canella *alba.* In cases of dyspepsia which permit the use of Tonics, it is an admirable addition to simple bitters; with which intention it is often used on the Continent, although seldom in this country. It has been more neglected than many less valuable medicines.

Canella Bark. *Canella,* L. *Canellæ Cortex,* E.D.—This bark is the product of the Canella *alba*†, a tree which is a native of Jamaica and some other of the West India islands. It belongs to the natural order *Guttiferæ.* The Canella found in the shops is the bark freed from its epidermis. It is in pieces of from five to eight inches in length, and from one to two in breadth; some quilled, others nearly flat: but it varies greatly both in size, thickness, and quilling, according as it has been taken from

* Apparatus Medicaminum, vol. iv. p. 56.

† Woodville's Medical Botany, p. 694, pl. 237. Sloane's Jamaica, vol. ii, p. 87, t. 191, f. 2. London Dispensatory, art Canella alba. Richard, Hist. Nat. Med. tome ii, p. 700. Lindley, 116. Lindley inquires whether it ought not to be regarded as constituting a distinct nat. ord. under the name *Canelleæ?* Cartheuser named it *Cortex Winteranus spurius.*

younger or older branches. The interior of this bark is of a pale-orange hue; the exterior whitish: it has the fracture of marble. Canella alba has an aromatic, pungent taste, leaving a slight bitterness in the mouth: the odour somewhat resembles a mixture of cloves and pepper.

MM. Petroz and Robinet analysed Canella *alba*, and obtained *saccharine matter*, crystallizable and resembling mannite; a peculiar, *bitter resinous principle; resin;* an acrid *volatile oil; gum; albumen;* and *fecula.* Alcohol is its proper menstruum, taking up the whole of the oleo-resin; whilst water takes up the gum, fecula, and albumen, with a portion of the bitter, but very little of the oleo-resin. The infusion, therefore, possesses little of the warmth and pungency of the bark: it is not affected by tincture nor infusion of galls, lime-water, tartar emetic, the salts of iron, nor those of mercury; all of which, therefore, may be prescribed in conjunction with it; but, in consequence of the albumen, it is precipitated by nitrate of silver; and, owing to the gum, it throws down diacetate of lead. The *volatile oil* can be obtained by macerating the bark and afterwards distilling it with water. It is thick, heavy, yellow, very pungent, and gratefully aromatic.

Canella alba is a powerful Excitant. It is an useful addition to tonic medicines in those cases in which a cordial is required, as in some varieties of dyspepsia and in atonic gout. From its not acting on the salts of iron, it is an excellent vehicle for these in the treatment of chlorosis, and other diseases of cold, leucophlegmatic habits. It is a good adjunct to jalap, colocynth, and other griping purgatives. It is most useful when administered in the form of powder, in doses from gr. x to ʒss, and may be combined with sulphate of potassa, rhubarb, and bitters. It enters into several officinal preparations*.

CASCARILLA BARK. *Cascarilla.* L. E. D.—The London and the Dublin Colleges have erred in regarding this bark as that of Croton *Cascarilla;* for, in addition to the testimony of Woodville and Dr. Wright, we have that of Dr. Lindley, who has received specimens of the plant from the Bahamas, which leaves no doubt that it is Croton *Eleuteria*, as stated by the Edinburgh College. The tree is a native of Jamaica, the Bahama Islands, and Paraguay. It belongs to the natural order *Euphorbeaceæ*†. This bark is generally brought home in quilled pieces, thin, compact, and breaking with a resinous fracture. The epidermis is whitish, rough, cracked, and covered, like the Cinchona bark, with various lichens, some of which are

* Vinum Aloes. L.; dose, as a stomachic, one to two fluid drachms; as an active purgative, one to two fluid ounces. Vinum Gentianæ, E.; dose, one to eight fluid drachms. Tinct. Gentianæ comp. E.; dose, half a fluid drachm to two drachms. Pulvis Aloes cum. Canella. D.; dose, five to fifteen grains.

† Woodville's Med Bot. third edition, p. 629, pl. 222. London Dispensatory, art. Croton. Richard, Hist. Nat. Med. t. i, p. 582. Lindley, 180.

very elegant, and belong chiefly to the Graphideæ. It has a bitter and slightly acrid taste, and an agreeable, aromatic odour, which is communicated to boiling water. This odour, depending on the oleo-resin which the bark contains, is exhaled when the bark is burnt; on which account it is used in India to diffuse an agreeable smell, resembling musk, in the houses of the natives. The volatile oil is easily obtained by distillation with water; it is of a yellowish-green colour, has a sp. gr. 0.938. The active properties of the bark are taken up both by alcohol and by water. According to Tromsdorff, the analysis yields 18.7 of mucilage, and bitter extractive; 15.1, resin; 1.6 volatile oil and woody fibre, 64.6 = 100.0; but, from the effect of various reagents, it evidently contains also tannic acid. Its infusion yields precipitates with sulphate of iron, acetate of lead, lime water, and infusion of yellow Cinchona bark.

Cascarilla is a very valuable Tonic; its aromatic qualities greatly aiding its tonic powers in dyspeptic affections. It was introduced into practice in 1686 by Professor Stisser, and was employed as a substitute for cinchona bark in the cure of intermittent and remittent fevers: but its powers in these diseases were greatly overrated. It is usually said to be an excellent addition to cinchona; but this refers to the pale cinchona only, as it precipitates the infusion and decoction of the yellow bark. It is advantageously administered in asthma, flatulent colic, the latter stage of dysentery, and in diarrhœa; indeed, in every affection in which the combination of a Tonic and an aromatic is indicated. In the gangrenous thrush of infancy it is peculiarly serviceable; and no less so in that state of languor and emaciation, accompanied with a tumid, tense abdomen, which depends on obstruction of the mesenteric glands. Owing to the volatile oil, in some cases, exciting too powerfully, this bark cannot be employed where there is the least tendency to inflammatory action. It has been supposed to favour a determination of blood to the hæmorrhoidal vessels.

The powder of the bark may be administered in doses of twelve grains to a scruple; but it is most frequently prescribed in the form of infusion, to which the compound tincture of cinchona is an admirable addition. The London College orders, also, a Compound Mixture, in which the Cascarilla is combined with vinegar of Squill and Compound Tincture of Camphor; and all the British Colleges order a Tincture*.

Cusparia Bark. *Cusparia.* L. E. *Angustura.* D.—This bark is the production of the Cusparia *febrifuga* of Humboldt,

* Infusum Cascarillæ, L. E. D.; dose, one to three fluid ounces. Mistura Cascarillæ comp. L.; dose, one to nine fluid ounces. Tinctura Cascarillæ, L. E. D; dose, one to two fluid drachms.

the Bonplandia *trifoliata* of Willdenow*, which St. Hilaire supposed is a species of Galipea; an opinion which has been confirmed by Dr. Hancock, who says it is not the Galipea *Cusparia* of De Candolle, but another species, which he has named C. *officinalis*. It is a handsome tree, a native of the Orinoko, South America, belonging to the natural order *Rutaceæ*. The leaves are trifoliate, the leaflets from six to ten inches long, oblong, acute at both extremities: the flowers white and hairy: the stamens distinct, but five abortive: the anthers without appendages: the stigma simple and capitate. Cusparia Bark is in pieces from six to twelve inches in length: sometimes quilled and slightly bent. The epidermis is whitish-yellow, unequal, rough, the interior of a fawn colour, hard, firm, breaking with a resinous fracture, and, when pulverized, giving a powder of a brownish-yellow hue, which, triturated with magnesia, exhales ammonia. If the bark be chewed and retained for some time in the mouth, it tastes bitter, aromatic, and leaves on the palate an acrid, *astringent, nauseous* taste. Both cold and hot water take up its active principles: alcohol dissolves the bitter and aromatic. Proof spirit is its proper menstruum.

The aqueous Infusion of Cusparia Bark is precipitated by infusion of gall-nuts, and other astringent vegetable infusions and decoctions; but neither by solution of gelatine, nor by tartar emetic. It is also precipitated by the sulphates of iron, of copper, and of zinc. The nitrate of silver throws down a copious white precipitate, which gradually acquires a dull purple hue on being exposed to the light; affording a presumption that this Bark contains hydrochlorate of ammonia. With the salts of Lead, bichloride of Mercury, the carbonates of Potassa and Soda, chloride of Barium, and lime water, precipitates are produced. Ammoniated-sulphate of copper causes a pea-green precipitate. Nitric acid deepens the colour nearly to a blood-red, and, after some time has elapsed, causes a precipitate of a lemon-yellow hue: hydrochloric acid causes no precipitate; but, after it is added, a solution of the ferrocyanide of potassium throws down a copious yellow precipitate: sulphuric acid produces no precipitate. If the powdered bark be digested with sulphuric ether, and the solution evaporated on the surface of water, a thin pellicle of resin is left. From these facts, we may conclude that the chief components of this Bark are—a trace of *Brucia, hydrochlorate of ammonia, gum, volatile oil, resin, bitter extractive, Igasauric acid,* and *tannin;* that it displays no traces of either tannic or gallic acid†. Its odour depends on the volatile oil,

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* Plant Equinoct. ii, p. 59, t. 57. London Dispensatory, art. Cusparia. Trans. of the Medico-Bot. Soc of London, vol. i, part i, p. 17. Richard, Hist. Nat. Med. vol. ii, p. 777.

† Fisher has analysed Cusparia, and gives the following as its constituents:—0.3 volatile oil, 3.7 peculiar bitter resin, 1.7 hard bitter resin, 1.9 soft balsamic resin, 0.2 elastic resin, 5.7 gum, 89.1 lignin, = 102.6.

which can be procured in a separate state by distillation with water. It is lighter than water, acrid, has the odour of the bark, and a yellowish-white colour. The resin is of two kinds: *one* hard, brown, bitter, soluble in alcohol, liquor potassæ, and acetic ether; but not in sulphuric ether, nor in oil of turpentine : the *other* soft, greenish yellow, acrid, soluble in alcohol, ether, oil of turpentine, and fixed oil; but not in liquor potassæ. Pfaff, who has stated these distinctions, leads us to suppose that it is the resin, not Brucia, which causes the red colour when much nitric acid is added to the infusion. Saladin, by exposing the alcoholic tincture, made without heat, to spontaneous evaporation, obtained tetrahedral crystals, which he regarded as a distinct salt, and named it *Cusparin.*

This bark was first brought to this country in 1788; and, as the plant yielding it was then unknown, it was named Angustura Bark, from the Spanish appellation *Corteza del Angostura:* Angustura being the vulgar name of the town of St. Thomas, the place of its export*. The native name of the tree is *Cuspare;* thence the appellation *Cusparia.* When the bark is good, the lichens which mark its qualities are the same as those of the Cinchona *Condamima;* but the Myriotrema is peculiar to the Cusparia, and always distinguishes the true from the false bark.

A bark has been substituted for and mixed with Cusparia, which is of a poisonous character: it is known by the appellation of *false Cusparia.* It was supposed to be the bark of Brucia *ferruginea,* or *anti-dysenterica,* a plant of the natural order Xanthoxylaceæ, a native of Africa: but the plant yielding the *false Cusparia Bark* is now supposed to be that of Strychnos *nux vomica.* It is in longer pieces than the true Cusparia; is more or less quilled, heavy, compact, and breaks with a brittle, mealy fracture; but it is less fragile than the true Cusparia. The epidermis is covered with distinct, rust-coloured, warty excrescences. Its powder is a lighter yellow than that of the true Bark; it is inodorous; impresses no aromatic flavour nor acrimony on the palate, but the most disgusting, durable bitter. It is distinguished from the true Bark chiefly by the effects of the following reagents on its infusion :—1. Carbonate of potassa deepens the red colour of the Infusion of the true Bark, and gradually deposites a clear, *citron-yellow,* flocculent precipitate: in the Infusion of the false Bark, the precipitate is *greyish-yellow.* 2. Sesquichloride of iron causes a dark greyish-brown precipitate, verging to an *ash-grey,* in the Infusion of true Cusparia: it forms a clear yellowish-green in the false. 3. Water, acidulated with hydrochloric acid, digested with the powder of the false Cusparia, takes a beautiful, clear green colour, when solution of Ferrocyanide of Potassium is poured on it, and in a short time

* Brande on Angustura Bark, Lond. 1793.

Prussian blue is deposited: this does not occur with the true Cusparia. 4. The bark of false Cusparia contains much Brucia, which causes the Infusion to strike a deep red colour with nitric acid; but it remains clear: the true Cusparia is similarly affected. 5. The false Cusparia, taken into the stomach, causes the sensation of stinging by ants over the skin, and slight tetanic convulsions.

As a medicinal agent, Cusparia Bark possesses both excitant and tonic properties. Its volatile oil renders it directly stimulant. In large doses, it causes nausea and purging. It was originally introduced for the cure of intermittent fevers, and was supposed likely to supersede the use of Cinchona Bark; but in this respect its powers were greatly overrated. It is, nevertheless, an excellent aromatic excitant and tonic in convalescence from fevers, dysentery, and diarrhœa; and, whilst it increases the appetite and restores tone, it rouses the nervous system, and never oppresses the stomach. In dysentery, however, much caution is required not to prescribe Cusparia until all inflammatory action is fairly subdued: as the acrimony of its volatile oil renders it injurious in all such conditions of the mucous membrane of the intestinal canal. In cases of dyspepsia which admit of the use of excitants, Cusparia Bark, owing to the combination of an aromatic with a tonic principle, is to be preferred to all others: it requires no tincture to warm it; an addition which, in my opinion, is always to be avoided in dyspeptic affections, unless the general strength be greatly reduced, and the pulse indicate a sinking condition of the habit.

The forms of administering Cusparia Bark is *Powder*, *Infusion*, and *Tincture*. The powder may be combined with Rhubarb; or, in hypochondriacal affections, in which the extrication of ammonia is useful, with Magnesia. The dose is from gr. x to ʒi. It is more frequently exhibited in the form of Infusion*. The Tincture† is only ordered as an adjunct to Infusion of Cinchona and Bitters.

CINNAMON‡ BARK, OIL OF CINNAMON. *Cinnamomum. Cinnamomi Oleum.* L. E. D.—Few Excitants of a vegetable origin, which owe their remedial powers to volatile oil, possess the importance of Cinnamon Bark, whether it is regarded in a national, a commercial, or a medicinal point of view. The tree, Cinnamomum *Zeylanicum*, Nees—or Laurus *Cinnamomum*, Linn.—which yields it, and also, as we are informed, yields the bark usually termed Cassia, belongs to the natural order *Lauraceæ*. It is a native of

* Infusum Cuspariæ, L. E. Infusum Angusturæ, D. Dose, one to two fluid ounces.

† Tinctura Cuspariæ, E. Tinctura Angusturæ, D. Dose, one to two fluid drachms.

‡ The name *cinnamon*—*κινναμωμον* of the Greeks, *kinamon* of the Hebrews—is supposed to be derived from *kayu-manis*, the Malay name of the tree.

Ceylon, Cochin China, Sumatra, Malabar, the Nicobar, and Philipine Isles. It is now cultivated in the Isles of France and of Bourbon, the West Indies, at Cayenne, the Brazils, and some other parts of South America. The Cinnamon cultivated in these places is not only different in quality, but is the produce of different species of plants: the best is that which is grown in Ceylon*.

The Cinnamomum *Zeylanicum*† is a small tree, seldom exceeding thirty feet in height, with a slender stem, branches which are somewhat angular, smooth, and covered with an ash-coloured rough bark; the leaves are in nealy opposite pairs, on short channelled petioles; entire, oblong, smooth, pointed, three-nerved: when mature, they have a strong aromatic odour and a hot, biting taste. The flowers are in terminal and axillary panicles; small, whitish, silky, slightly fœtid. The fruit is an oval bluish-brown, maculated berry. Cinnamon is the inner bark of the cultivated tree. It is sometimes freed from the epidermis before it is stripped from the branches, and always afterwards from a green, pulpy matter under it; a process performed by laying the inner side of the piece of bark on a convex piece of wood, and then scraping it: after which it contracts, dries, and assumes the quilled form. The smaller quills are put within the larger, and in this state it is exported. The acrimony of the recent bark is so great that it blisters the mouth. The bark is examined piece by piece, and sorted into three parcels, the first, second, and third sort. That which is evidently taken from *large* branches is rejected, as well as that from *very young* twigs; the first because the aroma is sharp and not very agreeable; the second because the oil contained in very young branches is rapidly dissipated in drying the bark. These inferior specimens of Cinnamon are put into the still for the purpose of obtaining the oil; for, besides the preparation of the bark, the volatile oil of Cinnamon is distilled in Ceylon.

There are four varieties of Cinnamon known in commerce —*Ceylon*, *Chinese*, *Cayenne*, and *flat*.

1. *Ceylon* Cinnamon is the best. It is in long quills, sometimes upwards of two feet long, slender, and splintery, composed of quills, the smaller slipped within the larger. The best Cinnamon is very thin, scarcely thicker than paper. It has

* Some years ago, Mahommed Ali, Pacha of Egypt, introduced the cultivation of Cinnamon into his country. The original plants were three cuttings from the garden of M. Boursault, at Paris: they have been so well managed, that some Egyptian Cinnamon has already found its way into the European markets.

Dr. Martius, the distinguished Bavarian naturalist, sent me a specimen of Brazilian Cinnamon: it is, in every respect, inferior to the worst of the Oriental Cinnamon.

† For a botanical description of the tree, see Woodville's Med. Bot. p. 670, pl. 233, third edition; Nees' Systema Laurinarum, 45; Lindley's Flora Medica, 329; and for an account of its varieties, cultivation, and mode of barking, see the London Dispensatory, art. Laurus.

a citron-fawn colour, an aromatic odour, and an agreeable, hot, slightly biting, sweetish taste, without leaving any nauseous or bitter impression on the palate. It does not break short, but bends before breaking, and has a longitudinal splintery fracture. It yields, in distillation with water, a small quantity of a highly acrid volatile oil, which has the odour and taste of the Cinnamon in a concentrated state. This oil is stated to be deposited in particular cells in the interior of the bark, or that part which is next to the wood in the living plant: but it exists there in combination with resin. When the Cinnamon is devoid of sweetness, and leaves a mawkish taste in the mouth; when it is very dark, or too light coloured; is deficient in aromatic flavour, or is bitter or astringent; then it is of an inferior quality*.

2. What is termed *Chinese* Cinnamon is thicker than Ceylon Cinnamon, and is the best Cassia in the European market. It is of a higher colour, has a stronger odour, is bitter and less sweet than the Ceylon Cinnamon, has a more pungent taste, and affords a larger quantity of volatile oil. The Chinese Cinnamon is, however, sometimes as thin and as good as the Ceylon†.

3. The *Cayenne* Cinnamon has the same characters as the Ceylon, but it is thicker; and the oil is more peppery than that of the Ceylon Cinnamon. A variety grown in the Brazils is much inferior.

4. *Flat* Cinnamon is taken from the larger branches of the tree; it is thicker than any of the other kinds, less quilled, slightly rugose, of a deeper yellow on the surface than the quilled, and of a paler yellow within and glazed: its fracture is fibrous, and its odour and taste are very feeble.

Both alcohol and water extract the active principles of Cinnamon. Ether, when it is digested for some time on the powder of Cinnamon and evaporated, leaves an oleo-resinous matter which tastes and smells powerfully like Cinnamon. The aqueous infusion is precipitated by persulphate of iron of an olive-green hue, and also by gelatine, demonstrating the presence of tannic acid: the acetate of lead discovers mucilage: iodine does not detect the presence of fecula: but when 10 grains of Iodine and 240 of Iodide of Potassium are dissolved in ℔ii of Cinnamon water, and the mixture exposed to a temperture of 32°, crystals are produced, which have been named Iodide of *Cinnamyle*, and consist of Iodine 28.08, × Iodide of Potassium 12.56, + Oil of Cinnamon 59.66, = 100.00. The infusion is also precipitated by lime-water and the carbonates of alkalies; the precipitates being tan-

* The best Cinnamon is the produce of the broad-leaved variety, and is termed *Rasse curundu*, or *Honey Cinnamon*, in Ceylon. Murray, Apparatus Medicam. iv. p. 422.—Percival's Account of the Island of Ceylon.

† Cinnamon is now also an article of trade from Borneo; and some of a very fine quality is grown in the central mountains of Cochin China.

nates of the oxides or alkaline bases. According to the analysis of Vauquelin, Cinnamon bark contains *volatile oil, tannic acid, mucilage, a colouring substance of a vegeto-animal nature,* an *acid,* and *woody fibre**. It is to the volatile oil, and some *bitter resin* which Vauquelin has overlooked, that the active properties of the Cinnamon are to be ascribed. M. Planché asserts that it also contains *fecula* and *caryophylline*†.

The *volatile oil* of Cinnamon—Oleum Cinnamomi, L. E. D.—can be obtained by simple distillation with water; but, in Ceylon, the bark is macerated in sea water for two days before it is put into the still. It is more easily procured by distilling the alcoholic tincture nearly to dryness, then mixing the extract with water, and redistilling: two kinds of oil come over; one lighter, the other heavier than water. The water in which the bark is distilled to yield the oil, remains highly charged with it; but the quantity of oil obtained is extremely small, being less than a drachm from ℥xvi of the bark. The Ceylon oil has a golden-yellow colour, possesses a sweetish, hot, biting taste, and the odour of the bark, and is heavier than water. Its sp. gr. is 1.03 to 1.09. Nitric acid, when added to it in equal quantity, acts violently upon it and chars it: but, in less quantity, and when the action is carried to its conclusion, white, oblique, rhombic crystals are formed, converting the whole into a crystalline mass‡, which is said to be a nitrate of the oil. Both strong sulphuric acid, gaseous hydrochloric acid, and chlorine, also decompose the oil. Mulder, as the result of nineteen analyses, has stated the ultimate components of Oil of Cinnamon to be C. 20, + H. 11, + O. 2, = 149.40§. In long-kept oil, crystals of an acid, which has been called cinnamic, are deposited, and the oil deepens in colour‖.

As a medicinal agent, Cinnamon is a powerful Excitant, acting primarily on the nerves of the stomach, awakening a sensation of warmth at the epigastrium, exciting the spinal marrow, and thence the whole nervous system, causing all the organs to exercise their functions with augmented energy. It exerts no specific action on the uterus, as some writers¶ have asserted. When its use is long continued, costiveness follows.

Cinnamon is scarcely ever employed alone as an Excitant; but it is generally added to medicines that possess no aromatic principle, and for covering the taste of nauseous medicines. It

* Journ. de Pharm. t. iii, p. 433.

† M. Planché first obtained this crystalline matter from Cloves, and thence named it *Caryophilline.*

‡ Edin. Pharmacopœia.

§ Berl. Iahrb. B. S. 176; quoted by Pereira, vol. ii, 784.

‖ Mr. Pereira informs us that an oil distilled from the leaf of the Cinnamon tree, has lately been imported. It is yellow, is heavier than water, and has the odour and the taste of Cloves.

¶ Sundelin—Wibmer.

cannot be prescribed in conjunction with the yellow Cinchona bark, on account of the *tannic acid* which it contains; but it may be united with Cascarilla, Quassia, Gentian, and Calumba. The Oil is a more energetic Excitant than the bark, and may be administered in the form of an oleo-saccharum; in which state it may be given with advantage, either united with Cinchona or any tonic bitter, or alone, in cramp of the stomach, flatulent colics, malignant cholera, and gout suddenly attacking the stomach by metastasis. It is well adapted for checking those vomitings attendant on some dyspeptic affections, apparently depending on a morbid condition of the spinal and ganglionic nerves, which this excitant seems to change by the impression which it makes on the sentient extremities of the gastric nerves. The tannic acid it contains, in combination with the volatile oil, admirably fits this bark for checking those cases of diarrhœa which, from the absence of all inflammation, seem to depend on direct debility of the intestinal canal. The powder may be given in doses of ℈ss to ℈iv; or the oil to the extent of from m. i to m. iii, either united with water, as an oleo-saccharum, or by means of mucilage or yolk of egg.

Cinnamon bark enters into several officinal preparations*, namely, a *compound powder*, a *water*, a *spirit*, and two *tinctures*. The water, when long kept, becomes nearly inert, owing to the subsidence of the oil. Both *tinctures* are useful adjuncts; the simple, containing the oil, tannic acid, and colouring matter of the bark; the compound, various aromatics in conjunction with the oil and tannic acid of the Cinnamon. The *compound powder* consists of nearly the same ingredients as the compound tincture, independent of the alcohol. They are all good Excitants. The oil is sometimes used locally in toothache, being dropped upon cotton and inserted into the hollow of the decayed tooth. It operates by rapidly exhausting the nervous excitability.

CASSIA. *Cassiæ Cortex.* E. was generally supposed to be the production of Laurus *Cassia*—Cinnamomum *Cassia (Nees* and *Eberm)*, a distinct species of Cinnamon; and as such it is set down in the Pharmacopœias of Edingburgh and Dublin,—*Cassia bark, Oil of Cassia*, E.—Laurus *Cassia. Cortex*, D.; and the accuracy of the opinion is supported by Mr. Pereira†. But, notwithstanding these authorities, I am not convinced that the

* Pulvis Cinnamomi comp. L.; Pulvis Aromaticus. E. D.; dose, from ten grains to one scruple and a half. Aqua Cinnamomi. L. E. D.; dose, half a fluid ounce to four fluid ounces. Spiritus Cinnamomi. L. E. D.; dose, two to four fluid drachms. Tinctura Cinnamomi. L. E. D.; dose, one to two fluid drachms. Tinct. Cinnamomi comp. L. E. D ; dose, one to two fluid drachms.

† Elements of Materia Medica, vol. ii, p. 786. It must be admitted that many difficulties still remain unremoved respecting the trees which yield the different varieties of Cinnamon.

statement of Mr. Marshall, who, from his appointment as a staff surgeon to the forces in Ceylon, had excellent opportunities of determining the fact, is incorrect; namely, that it is the bark of the same tree as that which yields the best Cinnamon. The Laurus or Cinnamomum *Cassia* grows in Ceylon; and there is a marked specific distinction in the ribbing of the foliage. In the Cinnamomum *Zeylanicum,* the leaves are ovate, taper to an obtuse point, are strongly marked with three longitudinal nerves, which extend from the base to the apex of the leaves, which are reticulated on the under surface: in the L. *Cassia,* the leaves are acute at each end, and three-nerved; but these longitudinal nerves, or bundles of vessels, do not extend the whole length of the leaf; on the contrary, they are given off from the midrib, vanish near the point, and the veinlets are curved on the under surface. The leaf of the Cassia is, also, waved on the margin; and it is less odorous than that of the true Cinnamon.

Mr. Marshall informs us that the Cassia is never barked, on account of the bitterness of its bark, which has, in some degree, the odour and taste of myrrh. The term Cassia, which was formerly used in Ceylon to specify the Cinnamon, is now employed only to designate *Coarse Cinnamon.* The worst kind of Cinnamon, that which is set aside for distillation in Ceylon, and also Cinnamon imported from Cayenne, have been brought into this country and sold as Cassia. It is thicker than good Cinnamon, and affords, when masticated, the idea of a slimy substance. The difference seems to consist chiefly in the cellular tegument, which is removed from the Cinnamon, and left in the Cassia. When this is scraped off, Cassia is in every respect the same as Cinnamon. On account of the retention of this tegument, the infusion of Cassia displays a reaction different from that which chemical reagents effect on the infusion of Cinnamon: the solution of persulphate of iron throws down a greenish precipitate; lime water a copious light-brown; and oxalate of ammonia a precipitate, an effect which must depend on the presence of some salt of lime, not found in good Cinnamon bark. Tincture of Iodine produces a blue colour in infusion of Cassia; which effect, and the precipitate with oxalate of ammonia, readily distinguish Cassia from good Cinnamon. The salts of lead, iron, silver, bichloride of mercury, and lime water, are incompatible with infusions of Cinnamon and of Cassia. A very striking difference exists in the action of strong nitric acid on the oils of Cinnamon and Cassia: on the former the action is violent; on the latter the colour is rapidly changed to a deep brown, and the decomposition of the acid is slowly effected after many hours; and is partially converted into a crystalline mass. The dose of the oil is m. i to m. iv.

The only circumstance which would induce me to lean to the opinion that Cassia and Cinnamon are different, is the difference of the action of reagents on the oil of Cassia and on that of Cinnamon. The colour of both oils is nearly the same; but the odour of oil of Cassia is less cinnamonic than that of Cinnamon, and it is somewhat acid. In truth, it has not the rich sweetness which Oil of Cinnamon first impresses on the palate; along with the sweetness it has a peculiar taste also, which the other oil has not.

The medicinal properties of Cassia are in every respect the same as those of Cinnamon. It may be given in the same doses, and in the same combinations. It is, however, less agreeable to the taste, probably owing to the cellular exterior part of the bark, which is separated in good Cinnamon. The Edinburgh College orders a *Water**, a *Spirit*†, and a *Tincture*‡ of Cassia.

* * * * * * *Flowers.*

THE CLOVE. *Caryophyllus, Oleum Caryophylli*, L. *Caryophyllus. Flores nondum expliciti et oleum volatile.* E. D.—The Clove is the unexpanded flower of Caryophyllus *aromaticus. Linn.* L. E. Eugenia *Caryophyllata*, *Thunberg*, D. a tree which is a native of the Moluccas§, and belongs to the natural order *Myrtaceæ*. It is a tall, handsome, evergreen tree, with a stem covered with a greyish, smooth bark‖. The Clove is the calyx of the flower, enclosing the ovary or germen. The unblown petals form a small, round head within the teeth of the calyx, at the summit of the ovary, which gives the nail-like appearance of the Clove¶; sometimes, however, the petals fall off, and leave the four points of the calyx. The Cloves are first procured from the tree when it is six years old. They are collected at Amboyna when they begin to redden, and are quickly dried by an exposure to heat and smoke, at a temperature of 120° Fahrenheit, until they assume their deep brown colour: after which the drying is completed in the sun. Those dried wholly in the sun, and those

* Aqua Cassiæ, E.; dose, from four fluid drachms to one ounce and a half.

† Spiritus Cassiæ, E.; dose, one to four fluid drachms.

‡ Tincturæ Cassiæ, E.; dose, one to two fluid drachms.

§ When the Dutch captured these islands from the Portuguese, they destroyed all the trees except those on the islands of Amboyna, Honimoa, Ana, and Nousalant. The French, however, in 1769, broke this monopoly of the Dutch, by introducing the tree into the isles of France and Bourbon, and their other colonies: in 1789, it was carried to the island of Dominica by an Englishman of the name of Buée; and, in 1803, it was introduced into Sumatra by Dr. Roxburgh.

‖ See Woodville's Med. Bot. third ed. p. 538, pl. 193. London Dispensatory, art. Eugenia. Richard, Hist. Nat. Med. tome ii, p. 403. Lindley, 75.

¶ The name is derived from the French word *Clou*, a nail.

which come from Amboyna and Bencoolen are the best. The Cayenne cloves are the worst. They ought to be of a bright brown colour, *plump, heavy, feel greasy, and be easily bruised; their odour should be agreeable and aromatic, and their taste acrid and biting.* They yield, by distillation with water, a large quantity of a heavy, highly pungent volatile oil.

Cloves yield their medicinal properties to water and to alcohol. The infusion contains tannic acid, striking a deep black-blue with persulphate of iron, and precipitates copiously with lime-water and acetates of lead. Iodine does not affect it; but the three mineral acids produce a flocculent precipitate; and, after a short time, the nitric acid displays effects which would almost permit the supposition that Brucia is present in the Clove. Thus, when it is added to the infusion, slightly warmed, a deep bright red hue, resembling that which Brucia and Morphia assume when treated with this acid, gradually appears. M. Bonastre, who first observed this fact, ascribes it to the oil of the Cloves, acted on by the nitric acid; and he properly cautions against the conclusions that might be formed of poisoning by Brucia or Morphia when the contents of the stomach, tested with Nitric acid, display this red appearance. According to the analysis of Tromsdorff, 100 parts of Cloves contain 18 of *waxy volatile oil*, 4 of *scarcely soluble extractive* with *tannin* (satiny), 13 of a *peculiar kind of Tannin*, 13 of *gum*, 6 of *nearly tasteless resin*, 28 of *lignine*, and 18 of *water*. M. Planché has found sulphur in them; and MM. Lodibert discovered *Caryophylline* and a green, acrid, aromatic, fixed oil in the Cloves of Molucca. Caryophylline is devoid of odour and taste: it crystallizes in fine needle-formed rays: is fusible and volatile. It is insoluble in water, scarcely soluble in cold alcohol, but soluble in boiling alcohol, in ether, and slightly in pure alkalies. It is reddened by sulphuric acid; and does not produce any effect on vegetable blues reddened by acids*. It is a compound of 79.5 *Carbon*, + 10.5, *Hydrogen*, + 10.0 *Oxygen*, = 100.0; or C. 20, H. 16, + O. 2, = 154.40.

In a medicinal point of view, Cloves are powerful Excitants, requiring much caution in their administration. An overdose, even of the Infusion, disturbs greatly the cerebral function, causing vertigo, cephalalgia, and dimness of sight. By regulating the dose, however, the Clove is one of the most certain of this class of remedies. It is also an useful addition to simple bitters, in cases which require a strong and immediate stimulant effect to be produced on the stomach; namely, atonic gout affecting that organ.

* Journal de Pharm. tome ii, p. 104.

The Clove is generally administered in the form of powder, in doses of grs. vii to grs. xii, mixed with sugar; and in that of infusion, which is ordered to be made with ʒiii of the bruised Cloves to a pint of boiling water, L. E. and ʒi to a half pint of boiling water, D. Ammonia is said to increase its efficacy*. It enters into several other officinal preparations†.

The *Oil of Cloves* is obtained from the Clove by distillation with water. It is a compound of a light and a heavy oil; the former of sp. gr. 0.918, a compound of C. 10, + H. 8, = 69.20; the latter of sp. gr. 1.079, having the properties of an acid and forming crystalline salts with alkalies; thence it has been called Eugenic acid. It is reddened by nitric acid. Its ultimate components are C. 24, + H. 15, + O. 5, = 201.88. The compound oil, that of commerce, when recent, is colourless; but it acquires a brownish-red hue by age. It has the odour of the Clove, and is hot and acrid to the taste. Its sp. gr. is 1.055‡. Its composition is 74.0279 of Carbon, + 8.1531 of Hydrogen, + 17.2189 of Oxygen, = 100.00§.

This oil is used as a corrigent to some drastic, cathartic gum-resins, the purgative power of which it considerably augments: it is also employed to destroy the nerves in decayed teeth, in which it acts almost like an escharotic, destroying at once the excitability of the nerve. The dose of the oil is from m. i to vi, triturated with sugar, as an oleo-saccharum, and diffused in water.

SAFFRON. *Crocus.* L. *Croci Sativæ Stigmata.* E. D.—Saffron is the dried stigmata of the Crocus *Sativus*, a plant which belongs to the natural order *Iridaceæ*‖. The plant rises from a *cormus*, or solid bulb. The leaves are long, linear, narrow, flaccid, sheathed at the base. The flowers are furnished with a two-valved membranous spathe; they are shorter than the leaves, of a pale purple colour, with three deeply divided linear, wedge-shaped, dark orange-coloured stigmata, fragrant, and hanging down on the outside of the flowers. These form the saffron. The plant is a native of Asia minor; but is much cultivated in England.

Saffron, in its dried state, when good, has a yellow colour, mixed with a deep reddish orange; its taste is pungent and bitter, and it exhales an agreeable odour. When powdered, it is

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* Pereira's Elements, p. 1094.

† Infusum Aurantii comp. L. D.; Infusum Aurantii, E.; Mistura Ferri aromatica, D.; Spiritus Ammoniæ aromaticus, L. E.; Spir. Lavandulæ composita, D; Confectio aromatica, L. D.; Elect. aromaticum, E.; Confectio scammonii, L.; Elect. Scammonii, D.; Vinum Opii, L. E. D.

‡ Bonastre. § Eattling.

‖ For the botanical characters of the plant, see Woodville's Med. Bot. p. 763, pl. 269, 3rd edit. Richard, Hist. Nat. Med. tome i, p. 410. Lindley, 576.; and for an account of the manner in which the stigmata are prepared for medicinal use, see London Dispensatory, art. Crocus.

of a beautiful orange colour. According to the analysis of Vogel and Bouillon la Grange, Saffron contains of

a colouring extractive matter (Polychroite). .	65.
Volatile oil.	7.5
Wax.	0.5
Gum.	6,5
Albumen.	0.5
Salts, with bases of Lime, Potassa, Magnesia, traces.	1
Water and lignine	20.
	100.00

Saffron yields its active principles to water, wine, proof spirit, alcohol, and ether. The active principle of Saffron is a volatile oil in combination with a peculiar colouring principle named *polychroite**.

Saffron is sometimes adulterated with the petals of the saff-flower, and the officinal marigold; but these frauds are of little consequence, as far as concerns the medicinal properties of the Saffron. A worse fraud is the mixing good Saffron with that which has been used and afterwards dried. When good, *Hay Saffron* should have a deep orange-red hue, mixed with bright yellow, which is the colour of the dry styles. When chewed, it should tinge the mouth and the saliva yellow. It is so light that ℥i of Saffron contains the stigmata of 4.320 flowers†. Little or no English Saffron is now sold. The best found in the shops is Spanish Saffron; the second best is French, and the worst Sicilian.

Both Water and Alcohol take up the colouring matter of Saffron. The aqueous infusion, when evaporated, yields a gummy extract, from which alcohol extracts the active part. Sulphuric acid tinges it blue, then violet; Nitric acid changes its colour to fugacious green.

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* Polychroite is separated from the other principles by infusing the Saffron in cold water, evaporating the infusion to the thickness of a soft extract; acting upon this with alcohol; filtering, and evaporating the alcoholic solution to one third. To separate the oil, a little potassa must be next added; and, having again saturated it with acetic acid, filter and evaporate, and the residue will be Polychroite. Ann. de Chimie, tome lxxx, p. 186.

Polychroite is a red powder, having a weak but agreeable odour, and a slightly bitter taste: it colours the saliva yellow, is soluble in cold water, and in alcohol, ether, the fixed and volatile oils, and the alkalies. It is partially soluble in the vegetable acids: nitric acid changes its colour to green; but this disappears on the addition of water. Sulphuric acid acts upon it in a similar manner: it first becomes blue, then violet, then green, and lastly brown: displaying those Cameleon changes which have given it its name. Chlorine destroys its colour. This principle was discovered by Bouillon la Grange and Vogel. It exerts no influence on the living system. Journ. de Pharm. tome vii, p. 327.

† Pereira's Elements, p. 696.

Saffron was regarded as an Excitant of considerable power by the ancients. It is to a heavy, acrid volatile oil that any medicinal virtue which Saffron possesses is to be attributed. Its power may be judged of by the quantity of this oil in a given quantity of Saffron: 100 parts generally afford 3 of oil. It excites the nerves of the stomach, and is partially absorbed. It exhilarates the spirits, and, like other Excitants, the excitement it produces is followed by exhaustion: in large doses, it affects the brain, causing headache, convulsive laughter, coma, and delirium*: and it is said that fatal effects have followed the imprudent use of Saffron†. Even the aroma, when tho stigmata have been recently gathered, is reported to be narcotic. Setting aside such exaggerations, the power of exciting the nerves renders Saffron an useful addition to narcotics in some convulsive and spasmodic affections. Thus the liquid laudanum of Sydenham, which contains one ounce of Saffron in the pint, in combination with cinnamon and cloves, is the best preparation which I know, in cases that require the combined action of a narcotic and an excitant. But much diversity of opinion exists with respect to the exciting powers of Saffron. The experiments of Dr. Alexander‡ would induce the belief that it is a very inert substance. My own experience does not accord with that of this distinguished physician; I am disposed to attribute much of the contradictory evidence advanced on this subject to diversity in the goodness of the drug.

Much evil has been produced by the custom, prevalent among the lower classes, of administering Saffron at the commencement of fevers attended with cutaneous eruptions, with the idea of throwing out the eruption.

Saffron may be administered in the forms of powder, infusion, or tincture. The dose of the powder is from grs. x to ʒi; that of an infusion made with ℥ss of the Saffron to half a pint of water is two table-spoonfuls given once in three or four hours: the dose of the tincture is from fʒi to fʒii. It is an ingredient in several officinal preparations. The only British officinal preparation is the syrup,—Syrupus Croci, L. E.: but it enters into several preparations§.

Cassia Buds, the unopened flowers of Cinnamomum *Nitidum*, are sometimes medicinally employed as an excitant: they possess properties closely resembling those of Cinnamon.

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* M. Hannin, Cours de Mat. Med. tome ii, p. 329.

† Riverius.

‡ Experimental Essays, p. 88; he took four scruples of Saffron without any obvious effect.

§ Confectio Aramatica, L. D.; Decoctum Aloes comp. L. D.; Pilulæ Styracis comp. L.; Pil. Styracis, E. D.; Tinct. Cinchona comp. L. E. D.; Tinct. Rhei comp. L. D.

* * * * * * * *Fruits.*

Pimenta Berries. *Pimenta*, L. E. D.—Pimenta, or Jamaica Pepper, is the fruit of the Eugenia *Pimenta* of De Candolle,—Myrtus *Pimenta*, Linn.—a tree which grows in great abundance in Jamaica, in the other West India islands, and in South America*; and belongs to the natural order *Myrtaceæ*.

The fruit of the Pimenta, known under the name *Allspice*, as it is imported, is globular, about the size of a small pea, of a dark reddish-grey or brown colour, rough, but not wrinkled, with a slight indentation on its upper surface. It is bilocular, and in each cell is a seed imbedded in a moist green pulp. Pimenta is the unripe berry; for the ripe fruit loses much of its aromatic quality, and becomes terebinthinate to the taste. The best kind of Pimenta is the produce of Jamaica. A kind of Pimenta is imported also from Tobago and Guadaloupe: it is larger than that of Jamaica, but is not so much valued, being considerably less aromatic. It is supposed to be the produce of a distinct plant, the Myrcia *pimentoides* of De Candolle†.

Pimenta has an agreeable odour, not unlike that of a mixture of cinnamon, cloves, and nutmegs; thence its name *allspice*: it has a pungent, hot taste, resembling that of pepper; properties dependent on the volatile oil which it contains, and which resides in the exterior coat chiefly, the kernel containing only one half the quantity which the outer coat yields‡: but it contains more than three times the quantity of astringent extract; and more than double of gummy extract and saccharine matter.

Water takes up the active principles of Pimenta; and, in distilling the berries to obtain the oil, a considerable portion of the flavour and taste of the Pimenta is communicated to the water, which is used, under the name Aqua Pimentæ, as a vehicle for other medicines§. The active principles of Pimenta are also taken up by alcohol and by ether. The spirit is officinal‖.

Besides the volatile oil, the tannic acid which Pimenta contains renders the Infusion incompatible with salts of iron. Nitrate of silver, the salts of lead, and infusion of Cinchona, also throw down precipitates. The mineral acids produce curious effects on the Infusion: the sulphuric and the hydrochloric redden it, and throw down pale rose-coloured precipitates; the nitric gives it a yellow hue, but no precipitate falls. The in-

* Woodville's Med. Bot. p. 541, plate 291, 3rd edit. London Dispensatory, art. Myrtus. Richard, Hist. Nat. Med. t. ii, p. 404. Lindley, 76.

† Prodomus, tom. iii, p. 243.

‡ Bonastre.

§ Aqua Pimentæ, L. E. D. Dose, one to two fluid ounces.

‖ Spiritus Pimentæ, L. E. D. Dose, two to four fluid drachms.

fusion also reddens the tincture of Litmus. These effects of reagents are explained by a knowledge of the constituents of Pimenta. The acids detected in a free state, are found to be the malic and gallic; the latter, in conjunction with the tannic, precipitates the salts of iron; the colouring and resinous matters are affected by the mineral acids; whilst the nitrate of silver demonstrates that the saline ingredients contain a chloride. According to the analysis of M. Bonastre, 1000 parts of Pimenta yield—

	Skin.	Kernel.
Volatile oil	100.00	50.00
Green fixed oil	80.00	25.00
Tannin	114.00	398.00
Gum	30.00	72.00
Colouring matter and resin	52.00	—.—
Saccharine matter	30.00	80.—
Malic and Gallic acids	6.00	16.—
Stearine	9.00	12.00
Lignine and water	535.00	30.00
Saline matters	28.00	18.—
	984.00	702.00
Loss	16.00	18.00
Red insoluble matter	——	88.00
Pellicle, residue of Cotyledons	——	192.00
	1000.00	1000.00

In this ample display of constituents, the volatile oil is the chief active medicinal agent; thence the oleo-saccarum of the Oil of Pimenta should be preferred to the berries.

Pimenta operates on the living system as an excitant, entering into the circulation and augmenting the force and the frequency of the pulse. It is particularly serviceable in the dyspepsia of broken-up constitutions, when much flatulence is present, and when there is a tendency to atonic gout: but, in every instance, much caution is requisite not to give it with the red and glazed state of the tongue which indicates subacute inflammation of the mucous membrane of the stomach. In measles, smallpox, and other Exanthemata, when the fever assumes the typhoid character, the watery infusion of allspice, sweetened with sugar and mixed with a little milk, is taken without reluctance by children, and proves highly useful. The distilled water is an excellent vehicle for other medicines.

Pimenta may be administered in the form of powder, in doses of from gr. x to ʒs; and, in cases requiring an astringent, it is the preferable form. As the first impression on the stomach is considerable when the powder is taken, the entire berries are sometimes swallowed instead of the powder. The best mode of

administering the Oil is to form it into an oleo-saccharum, or to combine it with some cretaceous powder, which, absorbing it, obtunds the acrimony of its first impression.

Besides the fruits which are chiefly employed for obtaining the volatile oil which is deposited in them, the natural order *Umbelliferæ* contains two plants which are officinal, and owe their properties to volatile oil, but are not used for obtaining the oil in a separate state; namely, Coriandrum *sativum*, and Cuminum *Cyminum*.

CORIANDER*. The fruit named CORIANDRUM, L. E.—*Coriandri semina*, D.—is that of Coriandrum *sativum*, an indigenous plant belonging to the natural order *Umbelliferæ*. It is cultivated in Essex; but it is not indigenous, being a native of the south of Europe. The plant rises about eighteen inches in height: the lower leaves are on slender, longish stalks, with wedge-shaped leaflets deeply notched; the upper are multifid, with linear segments. The flowers are white, tinted with red: the fruit is globular, formed of two hemispherical half-fruits, adhering by the concave surfaces†.

The odour of the dried fruit is peculiar, but aromatic; the taste sweetish and pungent; qualities depending on a volatile oil, combined, according to Tromsdorff, with a fat oil insoluble in alcohol‡. Their active principle is taken up both by water and by alcohol.

Coriander is moderately excitant; but it is rarely employed, except as an adjunct to some cathartic and other preparations§. The dose of the powder is from ʒss to ʒi.

CUMIN SEEDS,—*Cuminum*, L. E.—is the fruit of Cuminum *Cyminum*, another umbelliferous plant, which is a native of Ethiopia, cultivated in Sicily and Malta‖. The fruit somewhat resembles Caraway, but it is larger; the primary ridges are five, filiform and prickly; the secondary, four, prominent and prickly. The colour of the fruit is light brown or greyish yellow: the odour and taste resemble, but are less agreeable than, those of Caraway. The active principle is a very acrid volatile oil.

The fruit is a powerful stimulant; but it is seldom administered internally. The dose of the powder is gr. xv to ʒss. It forms an ingredient in a useful suppurant,—now rejected from the British Pharmacopœias,—namely, Emplastrum Cymini compositum.

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* The name is derived from κορίον, the Greek for Bug, the odour, in the green state of the plant, resembling that of that insect.

† Woodville's Med. Bot. p. 137, pl. 53, 3rd. edit. London Dispensatory, art. Coriandrum. Lindley, 58.

‡ Archiv. für Pharm. ii, 2.

§ Aqua Calcis comp. D. Confectio Sennæ. L. Elect. Sennæ. E. D. Infusum Sennæ comp. E.

‖ Woodville's Med. Bot. p. 143, pl. 56, 3rd edit. London Dispensatory, art. Cuminum. Lindley, 51.

CUBEBS. *Cubebæ*. L. E. *Oleum Cubebæ*. E. *Cubebæ fructus*. D.—A very natural and frequent combination of volatile oil—namely, that with resin—exists in this species of Pepper, the fruit of Piper *Cubeba*, a member of the natural order *Piperaceæ*, and a native of Java, the Indian Archipelago, Nepaul, and the Isle of France*. Cubebs resemble black pepper, except that they are a little larger and lighter coloured, and less wrinkled, and have pedicils attached to them: thence the name *Piper caudatum*†. They are the unripe fruit dried. They have a fragrant, agreeable odour, and a pungent, aromatic, bitter taste, which leaves a sensation of coolness on the palate resembling that of Peppermint. The oil which they contain is so very volatile, that it is soon dissipated if they be bruised; and, therefore, Cubebs should not be kept in a state of powder. Powdered Cubebs are sometimes adulterated with powdered Pimenta. According to the analysis of Vauquelin‡, they contain—a volatile oil nearly concrete; a small quantity of coloured resin, a resino-gummy coloured matter; extractive; and some salts. Monheim, who analysed Cubebs in 1835, states the following as their components:—2.5 green volatile oil, 1.0 yellow volatile oil, 4.5 Cubebin, 1.5 balsamic resin, 3. wax, 1.0 chloride of sodium, 6 extractive, 65.0 lignine, 15.5 loss, = 100.0§.

The *volatile oil*, which is procured by distillation with water, in the proportion of 10.5 per cent. is separable into two parts: a white concrete crystalline substance, *Cubebin*, a substance closely resembling Piperin; and a pale greenish straw-coloured fluid oil, lighter than water, and possessing the taste and odour of the Cubebs, and on which their efficacy depends. The sp. gr. of the oil is 0.929. It is a compound of C. 15, H. 12‖.

The powder of Cubebs, when taken into the stomach, acts primarily on the nerves of that organ, augmenting its energy, and through it increasing the action of the heart and arteries: it is, however, quickly taken into the system, the oil is separated and excreted by the kidneys, imparting its peculiar odour to the urine. The powder stimulates the intestinal canal through its whole extent, and imparts the same cool sensation in passing from the rectum as it leaves in the mouth. In doses from ℥ss to ℥ii, it acts powerfully on the mucous tissue, causing nausea and diarrhœa, with some febrile excitement: if no purging occur, the heat of the body is greatly augmented; the palms of the hands and the soles of the feet burn; the face flushes, and severe headache supervenes.

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* Blume, art. Bot. xi, 200 to 21. Richard, Hist. Nat. Med. tome i, p. 312. Lindley, 313.

† Blume asserts that the Cubebs which are sent to Europe are the fruit of Piper *Caninum*, L. E.—xi, p. 214.

‡ Journ. de Pharm. tom. vi, p. 309.

§ Journ. de Pharm. xx, 403.

‖ Soubeiran and Capitaine.

In 1818, Mr. Crawford published an account of the advantages derived by the Hindoo practitioners from the administration of powdered Cubebs in Gonorrhœa, and confirmed it by his own experience and that of the English surgeons in Java*. The experience also of European practitioners has since established and confirmed the value of this remedy in Gonorrhœa.

Regarding Cubebs as an Excitant, it may demanded, in what manner do they cure Gonorrhœa, which is an inflammatory affection? In replying to this question, we must bear in recollection that Cubebs are injurious in severe cases of the disease, when the inflammatory state is considerable, extending to the neck of the bladder, and accompanied with much symptomatic fever. In such cases I have seen them bring on bloody urine, strangury, and other violent symptoms. When these circumstances are absent, and the disease is confined to the mucous membrane, the morbid action which exists there is of a specific nature; otherwise a virus, resembling that which produced the disease, would not be generated. Now, when Cubebs are taken into the stomach, the volatile oil, separated from the resin and extractive, by the digestive function, is absorbed, passes by the kidneys, and thence acts on the bladder and the urethra, during the excretion of the urine. A new action in these parts is thus induced, sufficient to change the diseased state; and this new action being afterwards gradually let down, the diseased action does not return. It is also probable that the local effects of the Excitant on the intestinal canal may operate, in a certain degree, as a counter-irritant. This explanation is greatly confirmed by the fact, that Cubebs produce little benefit, unless their effect be soon apparent.

Cubebs are administered most advantageously in the form of powder, to ensure the efficacy of which it should be kept in stopped phials, or pulverized only when it is about to be used. The volatile oil may be prescribed instead of the powder; it possesses the advantage of not losing its properties by keeping. Pereira says that it is the best preparation of Cubebs†; but my own experience is at variance with that opinion. When the powder is administered, it is digested in the stomach, as I have already stated, and the volatile oil and the resin, entering the circulation, is carried to the kidneys, which it stimulates, thereby augmenting the quantity of the urine, and imparting to it its odour. Some of the benefit derived from Cubebs is undoubtedly due to this augmented secretion of urine, which assists in washing out the virus present in the urethra; but the inflammation and the pain is already abated; so that more depends on the specific action of the medicine on the mucous tissue than on its

* Edin. Med. and Surg Journ. vol. xiv, p 33.
† Elements of Mat. Med. ii. p. 757.

diuretic power. That this is the fact, is demonstrated by the utility of Cubebs in chronic inflammation of the bladder. When they prove useful in Gonorrhœa, the discharge is checked, and the inflammatory symptoms are allayed in less than eight or ten days; and when this does not occur, they seldom prove beneficial. Another very striking symptom, which is indicative of their proving curative, is a peculiar sensation of coldness in the rectum, when the fæces are passed. I have rarely found that they fail, when this symptom presents itself. The dose of the powder of Cubebs, sufficient to produce the usual effect of the medicine, is from ℈i to ʒss: but it is, sometimes, requisite to augment the dose to ʒi, three times a day. The best vehicle for administering the powder is milk.

A tincture of Cubebs, *Tinctura Cubebæ*, is ordered by the London and the Dublin Colleges; but, as far as regards Gonorrhœa, although Dr. Montgomery praises it, it is, in my opinion, a form of preparation of little value. It is a mere alcoholic solution of the resin and volatile oil. It may prove useful in chronic rheumatism, in some cases of which Cubebs are stated to have afforded relief*. Both an aqueous and an alcoholic extract are employed on the Continent.

In some habits, Cubebs excite urticaria, accompanied with great irritation and fever. In a case recorded by Sir B. Brodie†, this irritation was so considerable, from the administration of ʒi of the powder of Cubebs, that it tended to hasten the death of the patient. Mr. Broughton has also described a similar case, in which temporary paralysis followed the use of Cubebs in doses of ʒii three times a day; a state not to be wondered at, from so large a dose. In one case, which fell under my own observation, in which the extent of the dose was ʒi, so much febrile irritation was excited, that the life of the patient was in danger. It is not unlikely that such occurrences were the cause of the remedy formerly falling into disuse; for, although it was much prescribed in some diseases, yet, it had been neglected for many years.‡ Cubebs were not, however formerly used for the cure of Gonorrhœa, nor any inflammatory state of the mucous membrane. They were chiefly employed as a stimulant in dyspepsia, particularly in that variety of it attended with vertigo; and in hysterical affections.

Several cases of Leucorrhœa are recorded in which the administration of Cubebs seems to have been highly beneficial§; but, in prescribing them, the state of the uterus should be ascertained, as Cubebs might augment greatly any organic disease in

* See Dr. Crane's observations, Edin. Med. and Surg. Journ. vol. xxi, p. 305.

† Medical Gazette, vol. i.

‡ It is said that they were known in England 500 years ago, and in 1305 a toll of a farthing per pound was levied on carrying Cubebs over London Bridge. *Chronicles of London Bridge*, p. 155.

§ Edin. Med. and Surg. Journ. vol. xv, p. 318.

that organ. An infusion has been recommended as an injection in Leucorrhœa.

LAUREL BERRIES AND LEAVES. *Lauri Baccæ et Folia.* L. D.—These berries are the fruit of the Laurus *nobilis*, or sweet Bay tree, the type of the order Lauraceæ*.

It is a beautiful small evergreen tree, rising, in favourable situations, about twenty feet in height. The bark is smooth; the leaves alternate, lanceolate, acute, wavy on the margin. The flowers are in small, axillary clusters, of a yellowish-white colour, dotted, and membranous. The fruit is of the size and shape of a large pea, black, succulent. It is found in most of the countries of southern Europe, as France, Spain, Italy and Greece†.

Both the *leaves* and the *berries*, improperly so called, of the Laurel have an aromatic flavour, joined to a bitterness, and leave on the palate an astringent sensation. When bruised, the leaves have an agreeable fragrancy. The fruit, which is a drupe, yields a volatile oil by distillation. M. Bonastre has analyzed the fruit, and found in it—0.8 *volatile oil:* 12.8 fixed oil, 1.0 Laurin, 7.1 stearine, 1.6 resin, 0.4 uncrystallizable sugar, 6.4 Bassorine, 25.9 fecula; 17.2 gummy extract; 6.4 water, 1.6 salts, and 18.8. lignine‡.

When the oil is prepared, it may be administered as an oleo-saccharum in doses of m. x, which may be gradually increased to ʒi, if the stomach will bear so large a dose.

On the *volatile oil* and the *Laurin* depend the excitant power of the fruit. The oil, when separated by distillation with water, is limpid and colourless, has the odour of the leaves, and an acrid, bitter taste. It solidifies under 54° F. The Laurin is a crystalline solid, having the odour and taste of the oil. It communicates its bitter taste to boiling water; is insoluble in cold water, but soluble in alcohol and ether The action of both on the habit is too feeble to merit much attention; and, upon the whole, the Laurel, however dear to the poet, might easily be spared from the list of the Materia Medica.

It may not be out of place to notice here an oil which has lately been imported from South America, under the name Laurel oil. It is a pure, colourless, warm, pungent, aromatic oil, of a sp. gr. not exceeding that of alcohol. It has all the usual chemical properties of volatile oils; and is a solvent of camphor, caoutchouc, wax, and resin. The tree which yields it is said to be a Laurel; but this is uncertain: it is a native of South America,

* The classical character of the Laurel, as forming the groves of Parnassus and as the favourite plant of Apollo, is universally known; but few are perhaps aware that it has also been employed in crowning medical proficients. "Nec non," says Geoffrey, "quibusdam in locis novi Medicinæ Doctores Laura coronantur: inde fortasse Laureandi et Laureati dicuntur."

† Woodville's Med. Bot. 3d ed. p. 678, pl. 285. London Dispensatory, art. Laurus. Richard, Hist. Nat. Med. tome i, p. 529. Lindley, 340.

‡ Journal. de Pharm. x. p 30.

between the rivers Parime and Oronooko. The oil is procured by merely striking the tree with an axe, so as to divide the proper vessels, when it gushes out in such abundance that several quarts of it are obtained from a simple incision. This oil has been advantageously employed, as an internal stimulant, and as a rubefacient, applied to the skin in chronic rheumatism.

* * * * * *Seeds.*

CARDAMOM SEEDS. *Cardamomum.* L. *Cardamomi Semina.* D. *Cardamoms.* E.—The Cardamom is the seed of a plant which was formerly regarded as an Amomum, but which the investigations of Mr. Roscoe have proved not to belong to that genus. Dr. Maton endeavoured to fix the true botanical characters of the plant, which he named Elettaria Cardamomum, from the Malabar name, Ela-tari, applied to the ripe capsule of the seed; tari signifying a small seed, and Ela the name of the plant. It stands under the name Alpinia *Cardamomum* in the list of the London Pharmacopœia; and Renealmia *Cardamomum* in the Edinburgh list. The plant is a native on the range of the Gaughts in Malabar, and also in Cochin China*.

The best Cardamoms are cultivated on the highest range of the Gaughts†. An inferior species, the capsule of which is long and stalked, is brought from Ceylon.

Cardamom seeds are imported in their capsules; 100 of which yield 74 parts of seeds separated from them. The seeds are of a deep brown colour, angular, corrugated, pulverulent, have an agreeable, aromatic odour, and a warm, spicy taste; the shorter the capsule, the better the Cardamoms‡. Both water and alcohol extract their virtues. The watery infusion has a turbid appearance, is coloured blue by tincture of Iodine, and lets fall slight precipitates on the addition of alcohol and the acids; precipitates are also produced in it by sulphate of iron, bichloride of mercury, and acetate of lead. Cardamoms seem to consist entirely of fecula, mucus, some resin (?), volatile oil, and lignine.

The active principle is the volatile oil, which is deposited in the testa or skin of the seeds. Newman obtained 20 parts of volatile oil, 15 of resinous extract, and 45 of aqueous extract, from 100 parts of these seeds: but by a more recent analysis, made in 1834, Tromsdorff obtained, 4.6 volatile oil, 10.4 fixed oil, soluble in alcohol and ether, 2.5 of a salt of potassa, 3.0 fecula, 1.8 phosphate of lime, 0.4 colouring matter, 77.3 lignine, = 100.0

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* Woodville's Med. Bot. third edit. p. 734, pl. 251. London Dispensatory, art. Matonia. Linn Trans. vol. x, p. 229. Richard, Hist. Nat. Med. tome i, p. 416. Lindley, 566.

† White, Linn. Trans. l. c.

‡ Prima species Elettari planè rotunda et albicans. Rheede Malab. xi, t. 4 and 6.

of the seeds*. The volatile oil is limpid at first, and has the taste and odour of the Cardamom; but it loses these and becomes yellow and rancid when kept. The existence of the resin, however, is doubtful; for ether, digested on the seeds and evaporated on the surface of water, leaves nothing except volatile oil.

In a medicinal point of view, Cardamoms are Excitant; but they are chiefly employed, as aromatic additions to tonic medicines, in dyspeptic and gouty affections. They are sometimes ordered in combination with magnesia and rhubarb, in the flatulent colic of infants. The dose of the powder for an adult is from ten grains to a scruple. They are said to be stimulant, but not heating like other aromatics—a distinction which I cannot understand. The London and Edinburgh Colleges order two tinctures, and the Dublin one, of these seeds. The simple tincture, *Tinctura Cardamomi,* L. E. may be regarded as a solution of the volatile oil in proof spirit; the other, *Tinctura Cardamomi composita,* L. E. D. is one of those curious combinations which display neither ingenuity nor judgment in the inventors—a combination of the volatile oils of the Cardamom, Caraway, and Cinnamon, coloured with cochineal and sweetened with raisins. It is justice to the Dublin College to say that it leaves out the cochineal and the raisins. The dose of either tincture is f℥i to f℥ii. Cardamoms enter into several other officinal preparations†.

THE NUTMEG. *Myristica. Myristicæ Oleum.* L. E. *Myristicæ Adeps.* E. *Nux Moschata : Macis et Oleum Volatile.* D. A useful combination of volatile oil is found in the Nutmeg, the fruit of the Myristica *Moschata*‡, or *officinalis,* a plant belonging to the natural order Myristicaceæ. This tree grows in the Molucca Islands; but it is chiefly confined to the islands of Banda. Before 1770, the whole of Europe was supplied from the Moluccas with this spice; but, at that time, the Myristica *Moschata* was carried to the Isle of France, and there perfectly naturalized. It is also now cultivated in Cayenne and the West Indies§.

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* Journ. de Chim. Med. p. 196.

† Confectio Aromatica, L. D. Decoctum Aloës comp. L. E. D. Mistura Gentianæ composita, L. Pulvis Cinnamomi comp. L. E. D. Tinct. Cinnamomi comp. L. E. Tinct. Conii, L. E. D. Tinct. Gentianæ comp. L. D. Tinct. Rhei, E. D. Tinct Sennæ comp. L. D.

‡ Woodville's Medical Botany, third edition, p. 698, pl. 238. London Dispensatory, art. Myristica. Richard, Hist. Nat. Med. tome i, p. 465. Lindley, 73.

§ The tree has also been discovered in New Holland, the Southern Peninsula of India, and Cochin-China; but Mr. Crawford, in his History of the Indian Archipelago, affirms that the Nutmegs in these places have no aromatic properties, and are consequently useless. Many Nutmegs drop from the trees; but those only which are regularly plucked are exported to Europe. A good nutmeg tree yields from ten to fourteen pounds of nutmegs annually; but in this there are eight pounds only of *Nutmegs,* strictly speaking; two pounds being *Mace,* and the remainder, or four pounds, *shells.* It is a curious fact in political œconomy, that the consumption of Nutmegs and Mace in Europe has greatly diminished since the middle of the eighteenth century, although the price has also considerably diminished. In 1615, about 100,000 ℔s. of Nutmegs and 15,000 ℔s. of Mace were consumed in England: at present, the consump-

There are two kinds of Nutmegs found in commerce, the *wild* and the *cultivated.* The former is long, pointed, lighter, and less aromatic, than the cultivated Nutmeg. The shell, which is contained in a fleshy pericarp with a cotton down, in the wild, is smooth in the cultivated Nutmeg. The shell is indented by furrows, in which the *mace,* its arillus, lies. The cultivated Nutmeg itself is nearly round; its consistence firm and unctuous; its odour, strong, aromatic, and agreeable; its taste oily, hot, and acrid. When it is cut transversly and examined by the microscope, the dark-coloured veins are found to consist of cellular matter filled with volatile oil. The arillus or mace is divided into lacinæ, thick, unctuous, flexible, and of a cinnamon hue, with the taste and odour of the Nutmeg. Both the Nutmeg and the Mace are eaten and perforated by the larva of the Dermestes *Surinamensis.* Nutmegs are also occasionally punctured and boiled, to obtain the volatile oil; and the orifices afterwards closed with powdered Sassafras. This fraud is detected by the lightness of the Nutmeg*. According to the analysis of M. Bonastre, 100 parts of Nutmeg contain—24.0 of a *solid white matter* (stearine); 7.6 of a *fluid coloured butter* (elaine); 6.2 of a *volatile oil;* 0.6 of an *acid;* 2.4 of *fecula;* 1.2 of *gum;* and 58.0 of *ligneous matter* and loss†.

The Nutmeg yields its volatile oil by distillation: it is one of the few oils, produced in tropical climates, which are lighter than water: it possesses the odour and taste of the Nutmeg. Nutmegs, when heated, yield also to the press a concrete oil, which entangles, like a sponge, some of the volatile oil.

The *Mace,* which is the arillus of the Nutmeg, and surrounds the nut within the drupe, yields also, by distillation with water, a very acrid volatile oil. Besides the volatile oil, it contains also a fixed oil. According to M. Henry, *Mace* contains—1, a small quantity of *volatile oil;* 2, a large quantity of a *yellow, odorous, fixed oil,* soluble in ether, but insoluble even in boiling alcohol; 3, a nearly equal quantity of a *red, odorous, fixed oil,* soluble both in ether and alcohol; 4, a *gummy matter,* forming about a third the weight of the Mace: and 5, a small quantity of *woody fibre*‡.

The expressed concrete oil, *Adeps Myristicæ,* E. is imported in the form of small loaves or bricks: it is of a mottled orange

tion is only 56,960 of Nutmegs and 3620 of Mace. In Europe, two centuries ago, the consumption of Nutmegs was 400,000 lbs.; that of Mace, 150,000: at present (1832), 214,720 lbs. of Nutmegs and 250,040 of Mace are consumed.

* Formerly the Nutmeg was always imported in the shell, as in this state it can be long preserved; but the Dutch, in order to increase the demand for the annual produce of their newly acquired islands, and to secure their monopoly by sending the kernels in a state not fit to germinate, introduced the practice of freeing them from the shells; in which state the nutmeg is the most perishable of seeds.

† Journal de Pharm. Juin 1823.

‡ Journal de Pharm. tome x, p. 281.

and whitish colour, has a firm consistence, and the odour of the mace. It is a mixture of stearine, a yellow oil, and the volatile oil: the two latter are dissolved by cold alcohol and ether, and the stearine left.

The use of the Nutmeg as a medicinal agent is as old as Avicenna, who first employed it medicinally*. It is used chiefly as a grateful aromatic addition to some tonics that are apt to excite nausea and vomiting. It is also prescribed to relieve vomiting when it is present. The *Mace* answers the same purpose as the Nutmeg; but neither is much employed, except as agreeable aromatic additions to other medicines. The volatile oil is sometimes ordered, in the form of an oleo-saccharum, in flatulent states of the stomach and intestines, and in atonic gout attacking the stomach. It is also useful, in moderate doses, in dyspeptic states of the digestive organs, and in the diarrhœa of relaxed bowels.

The concrete oils of Nutmegs and of Mace are employed as local Excitants in neuralgic and rheumatic pains; and, with this view, they form a component of an useful stimulant application, the *Emplastrum Picis compositum* of the London Pharmacopœia.

The only officinal preparation of the Nutmeg is a distilled spirit, *Spiritus Myristicæ*, L. E. D. which is a simple solution of the volatile oil in diluted alcohol. The dose is f℥ii to f℥iv. Nutmegs also enter into a few officinal preparations†.

When the Nutmeg was formerly much employed as a condiment, and taken in large quantity, it was found to produce symptoms indicating a great determination to the head; on which account it should be cautiously used in apoplectic and paralytic habits‡. It is probable that the oil, separated by the digestive function, is taken into the circulation, and, being conveyed to the brain, favours congestion in that organ. Cullen mentions the case of a person who took two drachms of powdered Nutmeg: an hour afterwards, he was seized with drowsiness, which increased to stupor and insensibility; and, not long afterwards, he was found fallen from his chair, lying on the floor of his room. This state was succeeded by delirium, from which he did not recover for six hours§. The extent of the dose in powder should not exceed ʒss: the usual dose is gr. v to gr. x.

Such are the properties, physical, chemical, and remedial, of Volatile Oil, both in its *uncombined* state, and its *combined*

* Opera, lib. ii, cap. 456-503.

† Confectio Aromatica, L. D. Electuarium Catechu, E. D. Tinctura Lavandulæ composita, L.

‡ See Bontius, Rumphius, Lobel, Cullen, and others.

§ Cullen, Mat. Med. vol. ii, p. 204.

state as oleo-resin. The bounty of Nature, in supplying it in such variety, is more to be admired than the wisdom of the framers of Pharmacopœias in arranging in the Materia Medica so many substances the operation of which may be justly regarded as alike in every particular. If we take a review of the various articles contained in the list which has been just gone through, and select from the uncombined volatile oils those of Cajuputi, Peppermint, Rue, and Lavender, and from among the substances containing combined volatile oils, Caraway seeds, Acorus Calamus, Ginger, Serpentaria root, Cubebs, Cusparia bark, Cinnamon, and Pimenta, we shall possess ample means for fulfilling every indication for which Excitants of a vegetable nature, deriving their activity from volatile oil, can be required in the treatment of diseases.

b. Camphor.—*Camphora.*

L. E. D.

Camphor is brought to this country from Batavia and from Bombay. The former is usually re-exported, the latter is sublimed after it is melted and mixed with lime, which retains its impurities.

The crude Camphor consists of dirty-looking greyish grains, having the taste and odour of pure Camphor. Sublimed pure Camphor is a solid, white, semi-transparent, very volatile, combustible substance, unctuous to the touch, and closely allied to the volatile oils. It has a crystalline texture; is friable, and breaks with a crystalline fracture; but, nevertheless, it is ductile, and, therefore, not easily pulverized. It has a penetrating, peculiar, fragrant odour, and a bitterish, pungent, acrid taste, which is followed by a sensation of coldness on the palate. Owing to its volatility, it is gradually dissipated when exposed to the air, and, if kept in a covered glass vessel, crystallizes in hexagonal plates in stars on the side of the vessel exposed to the light. Its specific gravity is 0.9857. At 288° Fahr. it melts, and boils at 400° Fahr.: it is readily ignited, and burns with a brilliant flame, forming much smoke.

Camphor is scarcely soluble in water; but when triturated with it, enough is dissolved to communicate both odour and taste to that fluid. Ether, alcohol, strong acetic acid, fixed and volatile oils, carbonic acid, and the mineral acids diluted, dissolve Camphor; but it is again precipitated by adding water to the solutions. Strong sulphuric acid converts it into a substance resembling artificial tannin: nitric acid into Camphoric acid.

Camphor, according to Dumas, is an oxide of Camphene, which is a compound of C. 10, + H. 8: thence Camphor appears to consist of 10 equivalents of Carbon (6.12, + 10) = 61.20, + 1 of

Oxygen, = 8, + 8 of Hydrogen, = 8 : = 77.20. But chemists have differed in their statements of the elements of Camphor, as the following table demonstrates:

ELEMENTS.	NAME OF CHEMISTS.					
	Gold.	Dumas.	Saussure.	Thomson.	Ure.	Blanchet.
Carbon	74.67	78.02	74.38	73.91	77.38	77.96
Oxygen	14.09	10.39	14.716	11.60	11.48	10.61
Hydrogen	11.24	11.59	10.67	14.49	11.14	11.43
Nitrogen	0.0	0.0	0.34	0.0	0.0	0.0
	100.00	100.00	100.00	100.00	100.00	100.00

Camphor in some of its properties agrees with the volatile oils: but, instead of being converted into resin or artificial tannin by nitric acid, it is acidified, and converted into Camphoric acid*

The sources of Camphor are various; each producing a modification or variety of the substance. That brought to this country and employed in medicine, which may be taken as the standard, is procured by distillation from the roots and smaller branches of the Laurus *Camphora Sumatrensis* (Linn.), or Camphora *officinarum*. (Nees†.) Another variety, also medicinally used in China, but scarcely known in this country, is found concreted in the interior of the trunk of Dryobalanops *Camphora* or *aromatica*‡. All the essential oils of the Labiatæ deposite Camphor in crystals when they are exposed for a long time to the air§. M. Proust has ascertained that 10 per cent. of Camphor are obtained from the oils of Rosemary and Marjoram, 12½ from the oil of Sage, and 25 from that of Lavender‖. The volatile oils of some of the *Zingiberaceæ*—for instance, those of Zedoary, Maranta *galanga*, Kœmpferia *rodunda*, and Zingiber *officinale*—also yield camphor: and it has been procured from the roots of Anemone *pratensis*, Asarum *Europeum*, Andropogon *Schœnanthus*, Inula *Helenium*, and some species of the genius Aristolochia: an artificial variety is obtained by passing a stream of dry hydrochloric acid gas through purified oil of turpentine in a vessel surrounded by a mixture of snow and salt¶.

* Camphoric acid is a compound 2 eq. Camphene, = 138.4, + 5 Oxygen, = 40, = 178.4 (Ann. de Chim. et Phys. i, 225).

† Woodville's Medical Botany, third edition, vol. iv, p. 681, pl. 236. London Dispensatory, art. Laurus. Richard, Hist. Med. Nat. t. i, p. 558. Lindley, 333.

‡ Woodville's Med. Bot. third edit. vol. v, p. 124. Colebrook, Asiatic Researches, vol. xii, p. 539. London Dispensatory, art. Dryobalanops. Lindley, 196.

§ Camphor deposited by these are termed *Camphoroides*, as they are not perfectly identical with true Camphor.

‖ Journ. de Phys. Mars. 1790.

¶ Zea describes a species of Camphor, called *caratti* in South America, which exudes in tears from the bark of a tree.

The difference in these varieties is considerable: thus, the Camphor of the Dryobalanops, *Camphor of Borneo,* differs from that of the Laurel in being "opaque, of a chalk-white colour, in tabular plates, pulverizable without the aid of alcohol, and remaining in powder without agglutination; its sp. gr. is greater also than water, and it does not spontaneously sublime*." Its odour is that of a mixture of Camphor and pepper. The other varieties are still more distinct in their characters. A fluid Camphor, said to be the produce of the Dryobalanops, has also been brought to Europe under the name of oil of Camphor, and possesses excitant powers similar to those of the volatile oils†.

In examining the medicinal influence of Camphor, its local as well as its general physiologieal influence on animal life should be taken into consideration, to aid us in fixing its claim to the character of an Excitant.

In its volatile form, dissolved in the air, it operates as a powerful poison to many insects: thence its use in preserving clothes and vegetable matter from the destructive attacks of moths. It also destroys warm-blooded animals in the same manner, as was proved by the experiments of Carminati on birds‡. When given to quadrupeds by this physiologist, and also by Menghini§, various effects were produced; but in all it appeared to operate as a powerful stimulant: some became furious; others were oppressed with stupor; some were attacked with violent convulsions. Two drachms given to a dog brought on symptoms very closely resembling those of hydrophobia. Post-mortem examinations displayed the stomach to have been in a state of active inflammation. In those animals that suffered from stupor, the meninges of the brain, the lungs, the heart, and the intestines, were inflamed.

The influence of Camphor on man varies greatly according to the condition of the habit of the person to whom it is administered; and also according to the form of its administration. Topically it operates as an acrid: a piece held in the mouth causes heat, pain, and swelling of the mucous lining of the cavity; and the same in a minor degree takes place when it is applied to the skin. When applied to an ulcerated surface, besides acting as a powerful topical acrid, it is absorbed and exhaled by the lungs and the skin; but it is not secreted by the kidneys.

* Supplement to the Edinburgh New Dispensatory, by Dr. Duncan, p. 52.

† It has a terebinthinate odour, is lighter than water, in which it is insoluble. It is a compound of Carbon 20, Hydrogen 12, and rapidly attracts Oxygen when it is exposed to the air. I have found that when pure Oxygen gas is passed through this oil, it is converted into Camphor, resembling that of the Dryobalanops; thence there is some reason for thinking that this oil is the first state of the Dryobalanops Camphor. Pelouze, who is of the same opinion, supposes that the change is effected by the fixation of the elements of a certain quantity of water during the progress of vegetation.

‡ De Animal. ex mephitibus interitu, p. 186.

§ Comment. Benon. t. iii, p. 314.

Camphor, when taken in substance into the human stomach, excites a glow of warmth at the epigastrium, with an uneasy sensation: it is generally supposed to operate specially on the nervous system, the energy of which it is said to increase without raising the pulse; and this idea is thought to be supported by the transitory nature of its action. But the recorded opinions on this point are very opposite. Boerhaave, Stahl, and Neuman, maintain that it acts chiefly on the heart and the arteries, increasing their impetus; while Hoffman, Burserius, Cullen, and others, contend that the action and force of the pulse are diminished. Cullen even asserts that he never found the pulse quickened, nor the heat of the body increased, by giving it to the extent of half an ounce in the day. Dr. Alexander, who made many experiments on his own person with this medicine, and swallowed it in poisonous doses, namely, ℈ii at a time, concluded that it diminishes the temperature of the body and the celerity of the pulse: but, beyond a certain point, it produces the opposite effect. Having taken a very large dose of it, he was found foaming at the mouth; and his pulse quick, full, and hard: and, on his recovery, which did not take place until after six hours had elapsed, he complained of violent headache. His recovery was facilitated by drinking tepid water, which brought up part of the undissolved Camphor by vomiting. It is probable that, like opium and some other substances, the first effect of Camphor is excitant. This suggestion is indeed rendered highly probable, as in many of the instances of its primary sedative influence, related by Hoffman, Griffin, Cullen, Callisen, and others, the depression was followed by vascular excitement, and an elevation of heat of the surface. Opinions differ regarding the mode in which its stimulant effects are produced: it is contended by some that it passes into the circulation and is exhaled like sulphur by the skin, stimulating the system in *transitu;* by others, that it acts chiefly on the nerves, exciting the skin by the sympathy which exists between it and the stomach. My observations and experience induce me to adopt the latter opinion.

The first effect of a full dose of Camphor is certainly derived from its local stimulant power. In swallowing the dose, it is felt warm in the throat and at the epigastrium; and this sensation continues for a considerable time afterwards, sometimes occasioning thirst. Its influence on the gastric nerves is then propagated to the cerebro-spinal centre and entire system. During this time the heat of the surface is diminished, rigors sometimes occur, and vertigo supervenes, with perverted vision. The second general effect is one of increased action; the pulse becomes strong, frequent, and vibrating; the heat of the body is augmented; the surface is redder; the eyes glisten; and cephalalgia occurs. These symptoms are probably the result of its ab-

sorption. Experiments made on living animals, by injecting Camphor into the rectum, have demonstrated that it soon pervades all the tissues, and is made sensible in them by its odour: dogs thus treated often die in convulsions.

The medicinal use of Camphor has been little regulated by the opinions formed of its *physiological* action. Even those who regard it as an Excitant—on observing that, when taken in moderate doses, it softens and fills the pulse, and promotes diaphoresis, mitigates pain, dissolves spasms, and seems to rouse the nervous energy, without quickening greatly the pulse—have considered that it may be given in diseases of excitement, particularly when it is combined with antimonials. It cannot however be administered, except in small doses, in such cases; and much injury may result from its local influence, even in small doses, where there is subacute inflammation of the stomach or intestinal canal. It is said to obviate the irritating and stimulant effects of opium and other narcotics; and it has been much employed in maniacal affections. Its influence, nevertheless, as an Excitant, is much increased by combining it with small doses of opium: in which combination, also, it determines powerfully to the skin.

Camphor has been found extremely serviceable, as a stimulant, in *low fevers*, of that description which are termed putrid—an effect which is, undoubtedly, owing to its excitant properties: and it is in the latter and sinking stages of these fevers that its influence is most beneficial. Whether, in such cases, the benefit is to be ascribed to the absorption of the remedy, admits of doubt. The quantity that may be administered in these cases is so regulated by circumstances that it is impossible to lay down any rules respecting it. In some persons, a few grains excite powerfully; whilst others, in these fevers, can take ʒiii or ℥ss in the course of the day, not only with impunity, but even with advantage. In these cases it is advantageously combined with Peruvian bark, or the salts of Quina or of Cinchonia, or with Serpentaria, and aromatics. In gangrene, whether of the dry or humid kind, Camphor is found to aid greatly in stopping its progress and enabling the sound parts to throw off the diseased. In these cases its excitant properties are those to be looked to. It is, also, usefully employed, as a local stimulant, sprinkled on gangrenous sores. For the same reason, it is a beneficial addition to aromatics and opium, in cases of the Exanthemata when the circulation flags, and the warmth of the surface falls below the natural standard: thence it proves serviceable in smallpox, measles, and other eruptive fevers, when these assume a typhoid character, and especially when the eruption suddenly recedes. In erysipelas it has been given, in large and repeated doses, with the best effects. It has been employed with success in many affections proceeding from

a morbid state of the encephalon and the medulla spinalis; as, for instance, mania and several spasmodic affections. It quiets cough, arrests palpitation, relaxes spasms, and allays vomitings and intestinal pains which have often been erroneously ascribed to inflammatory states of the affected organs. The idea of its influence in diminishing irritation of the urinary organs, may have originated in its well-known anti-aphrodisiac influence: but I have never seen the opinion verified. It is in combination that it displays most strikingly its excitant powers: thus it augments the narcotic influence of opium; the diaphoretic of antimonials; and the purgative of senna, and several other cathartics.

Camphor may be administered in various forms. It is readily reduced to powder by the aid of a few drops of alcohol, and in this state it may be suspended in aqueous vehicles by means of mucilage; or it may be given in the form of powder, in combination with magnesia, aromatic powders, or bitters. Its insolubility in water renders that vehicle an unfit one for administering it, unless it be suspended by means of Acacia powder or yolk of egg; or, what is preferable, by first dissolving it in olive oil, and then forming this into an emulsion with mucilage of gum and water, or almond mixture. An emulsion is formed by triturating it with blanched almonds and sugar, according to the directions of the Edinburgh Pharmacopœia (*Mistura Camphoræ*, E.): but, in this case, the quantity of oil contained in the almonds is sufficient to keep the Camphor in solution; and, consequently, it must be strained, otherwise the Camphor soon separates and swims on the surface of the water. The *Mist. Camphoræ*, L. D. is made by dividing the Camphor first by alcohol, and then rubbing it up with water, and straining; the water retains a very small portion only of the Camphor. Magnesia is supposed to aid the solubility of the Camphor; thence the *Mistura Camphoræ cum Magnesia*, E. D. In extemporaneous prescription, however, Camphor may be advantageously ordered in the form proposed by Dr. Cassils, of Kendal, who recommends milk as a solvent of Camphor: ʒss of Camphor is formed into an excellent emulsion when triturated with f℥iv of milk and f℥viiss of water*.

Opinions have varied, even regarding the doses of Camphor. The usual dose is from three grains to a scruple: but on the Continent it is given to a much greater extent. Gizeke began with ʒss and increased the dose to ʒi. Stoll and other Germans have given it as freely. I have never seen its excitant effects produced by less than grs. viii given for a dose; and I have never had occasion to increase it beyond a scruple; repeated every fourth or sixth hour. Professor Hallé has remarked that

* Edin. Med. and Surg. Journ. vol. vii, p. 124.

Camphor, mixed with nitrate of potassa, administered in the interval of intermittent fever, prevents a return of the paroxysm; thus acting as an *anti-periodic.*

With respect to the topical employment of Camphor, when it is applied to the sound skin, it stimulates it, causing redness, heat, and increased action on the part; thence it is advantageously employed, as a rubefacient, to relieve internal pains; but, like all other local stimulants of a transitory nature, it is apt to favor metastasis, or a translation of inflammatory action, when there is any febrile excitement; and, therefore, it ought never to be employed in acute rheumatism and similar affections; although, in chronic rheumatism, a solution of Camphor in fixed oil, used as an embrocation, is often highly beneficial. A fact, however, should be noticed, which is, at first sight, apparently at variance with the local stimulant effects which have been just mentioned: when a lotion with Camphor is applied to a hot and inflamed surface, instead of stimulating, it acts as a refrigerant, producing an agreeable coolness—a circumstance depending on the great volatility of the Camphor.

As an external Excitant, it is employed also in solution in acetic acid*, alcohol†, fixed oil‡, turpentine§, and in combination with ammonia‖: it also enters as an ingredient into some other stimulating liniments. Soap liniment (*Linimentum Saponis.* L. E. D.) for instance, and the liniment of opium, *Linimentum Opii,* L. E. and the *Linimentum Hydrargyri compositum.* L. In my opinion, the most useful vehicle for its external application is oil, both on account of the minuteness of its division in that vehicle, and also the facility of its application. In all those cases in which its external application is indicated, the object is to produce a counter-irritant effect; and, therefore that vehicle must be the most useful which restrains its volatile properties, an effect which the fixed oils produce. I cannot comprehend what advantage is to be expected from its solution in acetic acid; as that agent is a more powerful rubefacient than the Camphor. It may aid the anodyne effects of opium, as an external application, when conjoined with it in a small quantity. Camphor is also used externally as a fumigation; the patient is covered with a blanket, which is tied or pinned close round the neck; half an ounce, or more, of Camphor is then thrown on an iron plate placed over a small chafing dish, within the blanket. The effect is a more copious perspiration than could be produced by the heated air. According to M. Dupasquier, an absorption of Camphor by the skin takes place.

* Acidum Aceticum Camphoratum, E. D.
† Tinctura Camphoræ, L. E. D.
‡ Linimentum Camphoræ, L. E. Oleum Camphoratum, D.
§ Linimentum Terebinthinæ, L.
‖ Linimentum Camphoræ comp. L. D. Linimentum Ammoniæ comp. E. D.

when treated with strong alcohol, yield up the acrid principle to the alcohol, leaving the fixed oil, which can be afterwards pressed out in the usual manner; and when it is thus obtained, it possesses only the bland qualities of ordinary fixed oil. The Vegetable Excitants, which depend on acrid fixed oil for their active properties, are Pellitory Root, Black and Long Pepper, and Capsicum.

* *Roots.*

PELLITORY ROOT. *Pyrethrum*, L. E. *Anthemis Pyrethrum. Radix*, D.—In Pellitory root, the acrid principle is of a fixed character. It is combined with Inulin and Gum.

Although all the British Pharmacopœias regard Pellitory as the root of Anthemis *Pyrethrum*, yet the plant is the Anacyclus *Pyrethrum* of De Candolle, a member of the natural order *Asteraceæ*. It is indigenous in the south of Europe, on the coast of Syria, and on that of Barbary*.

The roots, as imported into England, are in pieces of three or four inches in length, and about one-third of an inch in diameter, slightly curved and twisted, and of a dirty whitish grey colour, breaking with a short resinous fracture. They are inodorous, and, at first, apparently insipid; but, soon afterwards, the taste is extremely pungent, not unlike a mixture of salt and acid, with a pricking or thrilling sensation on the tongue and lips, which excites powerfully the excretory ducts of the salivary glands. In a longitudinal section of the root, a multitude of vesicular cells may be perceived, in which the acrid fixed oil is deposited. According to the analysis of M. Gauthier, 100 parts of Pellitory root contain—of *fixed acrid oil* 5.0, *yellow colouring matter* 14.0, *gum* 11.0, *inulin* 33, *muriate of lime* a trace, *lignine* 35.0, and *water* 2.0†. According to Parisel, its constituents are an acrid principle, *Pyrethrin* 3, + *inulin* 25, + *gum* 11, + *tannin* 0.55, + *colouring matter* 12, + *chloride of potassium* 0.79, + *silica* 0.85, + *lignine* 45, = 100.00. The difference in these statements is of little moment, as Pellitory is rarely or never internally prescribed.

The acrid principle is readily extracted by ether; it is odorous, reddish, has a hot, acrid taste, exciting salivation, and resembling a mixture of resin and fixed oil. When it is taken up by ether, the rest of the substance of the root is left almost insipid.

Pellitory root is a powerful Excitant; but its employment is confined to cases in which a local stimulus is necessary, as in

* Woodville's Medical Botany, third edit. p. 50 pl. 20 London Dispensatory, art. Anthemis. Richard, His. Nat. Med. t. ii, p. 221. Lindley, 460.

† Journ. de Pharm. 1818, p. 33.

paralysis of the tongue, and of the internal organs of deglutition, arising from circumstances affecting, partially only, the nerves of these organs. It is chewed, in a more or less bruised state, according to the power of mastication enjoyed by the patient.

* * *Fruits.*

CAPSICUM. L. E. D.—The Capsicum* *Annuum* is a native of South America and the East Indies. It is an annual plant, easily cultivated in this country, bearing its fruit ripe in September. It is arranged in the natural order *Solanaceæ*†. The fruit, which is the officinal part of the plant, is a juiceless berry; of various forms, round, oblong, conical, ovate, cordate, or horned; of an orange, red, green, or yellow colour; two-celled, with reniform seed. The best Cayenne pepper is made from bird pepper, Capsicum *baccatum* or *frutescens*: it is often adulterated with salt, sometimes with red oxide of lead: the former is detected by the taste; the latter, by boiling the pepper in vinegar, and adding sulphuretted hydrogen water, or solution of iodide of potassium; if a dark brown precipitate be thrown down by the former, or a yellow by the latter, lead is present. The pods of Capsicum should be gathered in September and hung up, separately, to dry.

The odour of Capsicum, when recent, is aromatic; but this is impaired by drying: the taste is hot and acrid, and remains long on the palate. Boiling water takes up the active principle of the Capsicum: the infusion is not affected either by acids or by alkalies; but it is altered by chloride of calcium, bichloride of mercury, carbonate of potossa, salts of baryta, sulphates of iron, of zinc, and of copper, acetate of lead, nitrate of silver, and lime water. Infusion of galls also throws down a precipitate in it. When evaporated to dryness, it affords a residue resembling starch in consistence. When Capsicum is boiled with alcohol and strained, the solution deposites, on cooling, a fatty matter of a beautiful orange-red colour, excessively acrid, but possessing no volatility. On dissolving the residue, or rather mixing it with boiling water, the fluid becomes very pungent and acrid; and, when evaporated to dryness, leaves a residue, from which ether takes up a yellow orange-coloured oil. This is the acrid principle of Capsicum. The acrid principle of Capsicum, therefore, has the character of a fixed acrid oil, but differs from it in being volatilized in a strong heat, and the oil being soluble in water: it is also soluble in weak, cold alcohol, ether, oil of turpentine, and in solution of potassa. It gradually acquires the consistence and appearance of wax, when long exposed to the air and light. The residue, after this action

* The name is derived from καπρω—I bite.

† Woodville's Med. Bot. third edit. p. 226, pl. 80. London Dispensatory, art. Capsicum. Richard, Hist. Nat. Med. t. ii, p. 718. Lindley, 509.

of alcohol, is a gummy and feculaceous matter, of a mawkish taste, combined with a red colouring principle; it has not the adhesiveness of gum, and approaches to the character of jelly. This examination accords with the analysis of Bracconot, who found Capsicum to contain *fecula, acrid fixed oil,* a *red waxy matter,* a *gummy matter, animalized matter, citrate of potassa, muriate* and *phosphate of potassa.* The acrid oil has been named *Capsicin.*

Capsicum is a powerful excitant, but more evanescent in its effects than the Peppers. It accelerates the pulse, and elevates the heat of the body. It is rarely internally administered, although it may be advantageously employed in atonic dyspepsia, and all cases in which the digestive organs are in a torpid condition.

It has been employed with benefit to allay the black vomit in tropical fevers. The only officinal preparation is the Tincture, *Tinctura Capsici.* L. E. D*. When added to acidulated Infusion of Roses in the preparation of m. x to f℥i of the infusion, it forms an excellent gargle in malignant sore throats.

PEPPERS.

a. Black Peppers. *Piper nigrum.* L. E. *Piperis Nigri Baccæ.* D.—Pepper is the unripe dried fruit of a trailing or scandent plant, Piper *nigrum*†, a native of the East Indies. It is most successfully cultivated at Sumatra and Malacca, in Java, Borneo, and of late years in the West Indies and in Cayenne. The plant belongs to the natural order *Piperaceæ,* of which it is the type‡. The entire dried fruit, which has a black colour and a shrivelled surface, is known by the name of *Black Pepper;* when the external coat is removed, and the surface exhibits a dull white colour, it is called *White Pepper.* Both kinds are imported in great abundance into Europe, not only for the purpose of medicine, but as a condiment most extensively and generally employed.

The fruit of Piper *nigrum* is produced on pedunculated, pendulous spadices; it is at first green, them becomes red, and lastly changes to black; all of which are seen on the same spadix at one time. The *Black* Pepper is gathered as soon as the first berries of the spadix ripen; and it is not unusual to gather them green, if they have attained their full size. When gathered, the spadices are spread out upon mats, or smooth spots of clean, hard ground, where the fruit soon dries and loses its green colour, becoming black and somewhat shrivelled, as it is imported into Europe. The ripe pepper shrivels less than the

* Tinctura Capsici. L. E. D. Dose m. x to one fluid drachm.

† Woodville's Med. Bot. third edit. p. 271. London Dispensatory, art. Piper. Richard, Hist. Nat. Med. t. i, p. 309. Lindley, 310.

‡ Every species of this natural genus is imbued with aromatic principles, and used in some part of the world: Black and Long Peppers, Cubebs, the Betel of the Malays, and the Kava of the South Sea islanders, are Pipers.

unripe, which often falls to dust. The stalks are separated by rubbing hard between the hands, which also tests the goodness of the Pepper; for if it be sound, this produces little effect on it; but if it be injured in the drying, or unsound, it is readily reduced to powder.

White Pepper, as I have said, is the whole and perfect berries stripped of the outer coat. In order to effect this, the Pepper is steeped in water for a fortnight, or until it swell and burst its tegument; from which it is afterwards separated by drying in the sun, and rubbing it between the hands. In India, the coat is removed from the undried fruit by means of a preparation of lime called *Chinam**.

The appearance of *Black Pepper* is well known: it is about the size of a small pea, covered with a dark brown, rough coat, which should not be too much shrivelled. It has an extremely pungent, biting taste, and a powerful aromatic odour. This pepper swells greatly when steeped in water, and the black coat can be readily separated. *White Pepper* is milder and less aromatic than the black; and it has this superiority, that it can be made only of the soundest fruit; and, consequently, it brings nearly double the price of black.

The infusion or decoction of Black Pepper in water reddens vegetable blues, owing to the presence of free malic and tartaric or uric acids. In making the decoction of Black Pepper, a quantity of green acrid oil is separated during the boiling, which does not appear in making that of White Pepper. This is a fixed oil; for in distilling the alcoholic tincture of Black Pepper, it remains in the retort. The decoctions of both Peppers yield a flocculent precipitate with infusion of Galls, which dissolves again at a heat of 120°, and indicates the presence of starch; on which account, the Tincture of Iodine strikes a blue colour with these decoctions. According to the analysis of Pelletier and M. Poutet, Black Pepper contains—1, *piperina* (to be noticed in the class of Tonics); 2, a concrete, green, fixed, *acrid oil;* 3, a *volatile oil*, nearly colourless and lighter than water; 4, a *gummy, coloured substance;* 5, an *extractive principle;* 6, *starch;* 7, *bassorine*, a kind of gum, resembling tragacanth; 8, *malic* and *uric acids;* some alkaline and earthy salts; and 9, *lignine*†. I am of opinion, however, that we may regard it as composed chiefly of *piperina*, a *concrete, fixed, acrid oil, starch*, and the *malic* and *uric acids*. The decoction forms precipitates with solutions of most of the metallic salts, sulphate and iodide of iron, acetates of lead, and bichloride of mercury. According to Lucä, who analysed White Pepper in 1832, the decortication causes a considerable difference in the constituents of Pepper.

* Pereira informs us that a white pepper, called *Fulton's decorticated Pepper*, is prepared by separating the husk from black pepper by mechanical trituration.—Elements of Mat. Med. p. 750.

† Journ. de Pharm. t. vii, p. 373.

In 100 parts of White Pepper he found 16.60 of *acrid resin,* 1.61 *volatile oil,* 12.50 *extractive gum and salts,* 18.50 *starch,* 2.50 *albumen,* 29.00 *lignine;* and 19.29 water. Poutet* obtained some piperina from White Pepper; and I, also, have procured it.

The pungency of the Pepper depends on the *oleo-resin* (acrid resin of Lucä), which is very soluble in alcohol and in ether. It is a powerful and valuable excitant. The volatile oil elevates a portion of it in distillation; thence it has the taste, as well as the odour, of Pepper: it is colourless, limpid, and of a sp. gr. 0.9932.

b. LONG PEPPER. *Piper longum,* L. E. *Piperis Longi fructus,* D. is the fruit of a perennial, scandent shrub, Piper *Longum,* a native of Hindostan, Nepaul, and Java†. The fruit is a condensed sub-cylindrical spike, about one inch in length, dry, firm, heavy, of an obscure grey colour. Each little eminence is a one-seeded drupe, firmly compressed, blackish on the outside, and white within. Like black pepper, it is gathered when it is fully grown, but before it is ripe. The spike is preserved in its entire condition.

Long Pepper is less aromatic than Black Pepper; but equally hot to the taste, and affording nearly the same constituents. The concrete acrid oil, oleo-resin, is even more pungent than that of the Black Pepper; at least, the pungency is more permanent.

Decoction of Long Pepper is affected by the same tests as that of common Pepper. According to the analysis of M. Dulong, this Pepper consists of—1, *Piperina;* 2, a *fat, concrete, very acrid matter;* 3, a small portion of *volatile oil;* 4, *extractive;* 5, *coloured gum;* 6, *starch;* 7, much *bassorine;* 8, a *malate* and *salts*‡. Ether digested on it takes up one part in four, and, when evaporated on the surface of water, leaves a resin impregnated with the pungent oil on which the taste of the Pepper depends§. I conceive, therefore, that the addition of a larger proportion of resin is the chief distinction between the components of Long Pepper and those of Black Pepper. This resin is not mentioned by Dulong. It also yields less piperina.

The effects of both these Peppers, as condiments, have been long known‖. As medicinal agents, they were long supposed to owe *all* their medicinal qualities to the acrid oil which they contain; but, since the discovery of *piperina,* this opinion has been set aside: it is, nevertheless, still justly admitted, that the exciting properties of Pepper are solely due to the acrid fixed oil,

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* Journ. de Pharm. t. vii.

† See Woodville's Med. Bot. third edit. vol. iv, p. 724, pl. 247. London Dispensatory, art. Piper. Richard, Hist. Nat. Med. tome ii, p. 314. Lindley, 311.

‡ Journ. de Pharm. tome xi, p 52.

§ The root of Piper *longum* possesses the virtues of the fruit in a weaker degree: it is employed, sliced and dried, under the name Pipula Moela, by the native Hindostanee physicians, in cases of palsy, tetanus, and apoplexy.

‖ The Greeks were acquainted with Pepper; and Hippocrates employed it medicinally.

oleo-resin. This oil, when separated, is too pungent to be tasted with impunity, unless greatly diluted with alcohol; and it is undoubtedly the most powerful of the vegetable Excitants. Applied to the skin, it reddens and inflames it; and thence we readily trace the cause of the sensation of almost insupportable, long-continued burning which Pepper, in large doses, excites, when taken into the stomach. It enters the circulation, stimulating powerfully the action of the heart, the arteries, and the capillaries; the brain and the spinal marrow. Like all powerful medicines, Pepper is highly beneficial when administered in moderate or proper doses: it affords an agreeable stimulus to the nerves of the stomach, promotes the secretion of the gastric juice, and, consequently, aids digestion in weak stomachs: but their abuse is followed by hazardous gastritis.

Pepper is as useful a remedial agent as a condiment, when judiciously administered. Steeped in rum, it is a well-known domestic remedy, among the poor, for the cure of intermittent fevers*. It operates by exciting copious perspiration; but when it does not arrest the rigors, and the hot stage supervenes, the fever is always more severe after the administration of Pepper: the indiscreet use of the remedy has even been productive of fatal consequences: much, however, depends upon the condition of the stomach at the time. Since the discovery of Piperina, doubts have arisen whether the curative power of Pepper in intermittents is to be attributed to that principle or to the acrid oil. In the few opportunities which I have had for trying the effect of perfectly pure Piperina, I have found it less serviceable when it has not been wholly free from the acrid oil. The oil alone has cured intermittents; but M. Majendie asserts his belief that this is owing to its retaining some Piperina: and this opinion finds support from the fact that chamomile flowers, which contain no acrid fixed oil, but contain Piperina, cure intermittents. At all events, the exciting power of Pepper can only be justly ascribed to its acrid fixed oil. Pepper is a useful adjunct to bitters, in atonic dyspepsia and in retrocedent gout. In India, an infusion of toasted Black Pepper is administered to check the vomiting in cholera†.

As a topical remedy, I have found the acrid oil of Pepper the best of all applications in relaxed states of the uvula. On touching the elongated uvula with it, that organ suddenly contracts. Pepper may be administered in the entire state, two, four, or six of the Pepper-corns at a time: or it may be given in powder, to the amount of five, ten, or twenty grains for a dose. Black

* Celsus recommends it for checking the rigor and bringing on the hot stage. "Ante accessionem allium edat, aut bibat calidam aquam cum pipere; siquidem ea quoque assumta calorem movent, qui horrorem non admittit."—De Medicina, lib. iii, c. xii.

† Ainslie.

Pepper is the active ingredient in the *Confectio Rutæ*, L. D. the *Confectio Piperis nigri*, L. D. and the *Electuarium Piperis*, E. which is intended as a substitute for *Ward's Paste*, an empirical remedy, much used in piles and fistulous ulcers of the rectum. It is only useful when piles occur in weakened and leucophlegmatic habits. Pepper is also a component in two external preparations: an ointment ordered by the Dublin College, *Unguentum Piperis nigri*, and the compound plaster of Cantharides, *Emplastrum Cantharidis compositum*, of the Edinburgh Pharmacopœia. The Long Pepper forms part of the confection of Opium*, of the aromatic powder†, the compound powder of Chalk‡, and the compound tincture of Cinnamon§ of the Pharmacopœias.

d. BALSAMS.

The characters which are regarded as distinguishing a Balsam are its containing *resin*, *benzoic* acid, and *volatile oil*. The general properties and appearances of a Balsam are those of the resins; but when it is heated, or is digested with water, the distilled benzoic acid is procured. As water thus dissolves the acid part of Balsams, it is probable that the acid exists ready formed in them. Alcohol and ether readily dissolve them; and when the solutions are poured into water, the fluid becomes milky, and resin is deposited. The strong acid dissolves them, and during the solution a portion of benzoic acid is separated. The resin of the Balsams differs from common resin‖. The purest common resin dissolves in sulphuric acid, affording a yellowish or reddish-brown solution, which precipitates whitish flocculi when dropped into water: the resin of the Balsams produces a beautiful red or deep crimson solution with sulphuric acid; and, when the acid solution is dropped into water, precipitates beautiful rose-red or crimson flocculi, which, when washed, do not contain any sulphuric acid; a fact demonstrated by nitrate of baryta, which, even when boiled over them, affords no sulphate of baryta. By heating any Balsam to expel the benzoic acid, and then dissolving the residue in concentrated sulphuric acid, and precipitating it with water, the purity of the Balsam is readily ascertained by the colour of the precipitate.

The Balsams are of different consistence; some being solid,

* Confectio Opii, L. D. Electuarium Opii, E. Dose, ten grains to half a drachm.

† Pulvis Cinnamomi comp. L. Pulvis aromaticus, L. D. Dose, five to ten grains.

‡ Pulvis Cretæ comp. L. E. D. Pulvis Cretæ comp. cum Opio, L. D. Pulvis Cretæ Opiatus, E. Dose, five grains to half a drachm.

§ Tinct. Cinnamomi composita, L. E. D. Dose, one to two fluid drachms.

‖ This remark was first made by M. Dulong d' Astafort.—Journ. Pharm. 1826, p. 37.

others of a semifluid consistence; both are, strictly speaking, excitants; but the solid are chiefly used as expectorants.

Semi-Fluid.

BALSAM OF PERU. *Balsamum Peruvianum.* L. *Myroxyli Peruviani Balsamum.* E. D.—This Balsam is the secretion of the Myrospermum *Peruiferum* of Decandolle, the Myroxylon *Peruiferum* of Linneus, a native of the forests of Peru, Columbia, and Mexico; found chiefly in low, warm, sunny spots near the river Maranon. It belongs to the natural order *Amyridiaceæ.* It is a handsome tree, with thick, grey, heavy resinous, aromatic bark, and alternate, pinnated leaves, consisting of acute, ovate, lanceolate, coriaceous leaflets, with transparent dots. The flowers are white; the fruit a legume with reniform seeds. When incisions are made into the bark of the tree, a white liquid Balsam is procured; and which, after its consolidation, is known in commerce, as Balsam of Tolu: when the bark and twigs are submitted in some manner to the action of heat, a semifluid Balsam, the Peruvian Balsam, is the result.

Balsam of Peru is a viscid, deep brown coloured fluid, somewhat of the consistence of fluid honey or treacle, having a fragrant odour, and a warm, pungent, aromatic, bitterish taste. It is inflammable, and in burning gives out much soot. It is only partially soluble in alcohol. When boiled in water for some time, the water becomes acidulated, and deposites, on cooling, crystals of an acid, which has been regarded as the benzoic, but which Fremy asserts to be *Cinnamic* acid. When distilled with water, it yields a reddish, limpid oil, in the proportion of $\frac{1}{18}$ of the Balsam employed; and the acid sublimes in the neck of the the retort. When distilled pure, very little oil is obtained; but if the heat be raised to 617°, a yellowish oil comes over abundantly, and benzoic acid sublimes; at a lower heat the products are an acid, water, and a dirty-looking benzoic acid. If the heat exceeds 617°, the Balsam is completely decomposed, and a black, pitchy, empyreumatic oil, with plenty of carbonic acid and carburetted hydrogen gas, comes over.

Sulphuric acid acts upon Balsam of Peru in the same manner as upon other Balsams. Nitric acid acts upon it with violence; but when the acid is diluted and distilled from Balsam of Peru, the liquid in the receiver smells of bitter almonds, demonstrating the presence of hyduret of Benzule, and, when treated with potassa, solution of protosulphate of iron, and muriatic acid, it shows evident traces of hydrocyanic acid. In this case, both the nitric acid and the cinnamic acid of the balsam are decomposed; the equivalent of nitrogen necessary to form the hydrocyanic acid is supplied by the nitric acid, whilst the carbon and hydrogen proceed from the cinnamic acid.

According to the analysis of Stolze, this balsam consists of 2.4 parts of brown, nearly insoluble resin; 20.7 of soluble resin; 69.0 of an oil; 6.4 of benzoic acid; and 0.6 of extractive; moisture 0.9, in 100 parts*. When two volumes of this Balsam and three volumes of Liquor Patassæ, sp. gr. 1.300, are heated together, a yellowish-brown oil swims on the surface of a black thick substance, which contains all the Potassa. On redistilling the oil, it becomes clear and colourless. Fremy calls it Cinnameine. When a solution of the oil in alcohol is boiled with an alkali, it solidifies, forming cinnamate of Potassa, cinnamic acid being first formed and united with the alkali†. Further investigation, however, is required to verify these results.

Balsam of Peru is a powerful Excitant, whether topically applied or taken into the stomach. Its influence in cleansing and stimulating foul, languid, and gangrenous ulcers has been well ascertained. When taken into the stomach, it stimulates generally, augmenting the power, and accelerating the movements of the heart and vascular system; and, also, extending its influence to the capillaries. It may be given to the extent of f℥i, triturated with yolk of egg to suspend it in water. It is occasionally, but not often, employed in old asthma, in debilitated persons. Its use in Phthisis has been properly discontinued.

e. ACRID PRINCIPLE.

* *Roots.*

HORSE-RADDISH. *Armoracia.* L. *Cochleariæ Armoraciæ Radix.* E. D.—This is the perennial root of a well-known indigenous plant, belonging to the natural order *Cruciferæ*‡. The fresh root has a powerful, penetrating odour, and a pungent taste; a great portion of which it loses in drying. These properties are due to an essential oil containing sulphur, which is readily detected by acetate of lead and nitrate of silver; and so acrid that it vesicates when it is applied to the skin. According to the analysis of Gutret, the constituents of Horse-raddish are *acrid volatile oil, bitter resin, extractive, sugar, starch, gum, albumen, acetic acids, acetate and sulphate of lime,* and *lignine:* but he makes no mention of sulphur.

Horse-raddish operates equally as a topical and a general excitant. When chewed, it stimulates the salivary glands, causing a flow of saliva. On account of its topical action, it is advantageously employed, in the form of a syrup, in atonic hoarseness. The syrup is made by infusing ℥i of the scraped Horse-raddish in f℥ii of boiling water, pressing the whole, and adding as much sugar to the liquid as will make a thick syrup. A teaspoonful

* Journ. de Chim. Med. i, p. 139.
† Ann. de Chim. et Phys. lxx, p. 180.
‡ Woodville's Med. Bot. third ed. p 400. Smith's Flora Brit. ii, 693. Lindley, 91.

is taken into the mouth and slowly swallowed: it must be repeated at short intervals until the voice is obtained. The dose for internal administration is ʒss to ʒi, in shreds. It enters into two officinal preparations*.

* * *Seeds.*

MUSTARD. *Sinapis.* L. E. *Sinapis Semina.* D.—These are the seeds of the Sinapis *nigra* and *alba*, plants which grow wild in almost every part of the world, and are cultivated in many countries. Both plants are members of the natural order *Cruciferæ*†.

The seeds of both species of Sinapis are small and globular; those of S. *nigra* have a dark-brown colour; those of S. *alba* are pale yellow. When bruised and moistened, they have a very pungent odour, although in the entire state they have scarcely any: their taste, when masticated, is acrid and biting. M. Thibierge analyzed Mustard, and obtained from it the following products:—1, a *soft fixed oil*, procured by pressure, of a dark greenish-yellow colour, soluble in alcohol and ether; 2, a *volatile oil*, obtained by distillation, of a golden-yellow colour, heavier than water, having a hot acrid taste, soluble in alcohol, and depositing sulphur; 3, an *albuminous vegetable principle;* 4, a large quantity of *mucilage;* 5, *sulphur;* 6, *nitrogen;* 7, the seeds, incinerated, appear to contain *phosphate* and *sulphate* of lime and a little *silex*‡. Much light, however, has been thrown upon the acrid principle of Mustard by subsequent analyses, especially that of Bontron and Fremy: and the former has ascertained that white Mustard contains neither *volatile oil*, nor any substance capable of forming it§: and that it owes its powers to a *fixed acrid substance* which does not pre-exist in the seeds. According to these chemists, black mustard seeds contain a *fixed oil, myrosyne*||, *myronate of Potassa*, a *fatty matter, gum, sugar, sinapisin, free acid, colouring matter*, a *peculiar green substance*, and *some salts.*

The fixed oil of Mustard has a sweetish taste, and a slight nauseous odour; it is soluble in 32 parts of alcohol and 16 of ether, is lighter than water, having a sp. gr. 0.8815; and, when boiled with litharge, it is changed into a soft, yellow, transparent viscid substance, which dries like varnish. The seeds yield $\frac{1}{5}$ of

* Infusum Armoraciæ compisitum. L. D. Dose, one to two fluid ounces. Spiritus Armoraciæ compositus. L. D. Dose, one to four fluid drachms.

† Woodville's Med. Bot. third edit. p. 403, pl. 146. London Dispensatory, art. Sinapis. Richard, Hist. Nat. Med. tome ii, p. 648. Lindley, 91.

‡ Journ. de Pharm. tom. v, p. 439. M. Henri, jun. and M. Gavot have discovered a peculiar acid in mustard, which they term *sulpho-synapic*, in which sulphur is supposed to exist in a peculiar state of combination. Journ. de Chim. Med. tome i.

§ Journ. de Pharm. tome xvii, p. 279.

|| *Myrosine* has some resemblance to vegetable albumen and emulsion, but it differs from both. It is in white, shining, volatile crystals, soluble in alcohol, ether, and the fixed oils: insoluble in acids and alkalies.

their weight of this oil, which, in large doses, operates as a purgative. When this oil is expressed, the marc is more pungent than the seeds previously were; on which account, the seeds are submitted to pressure previous to being formed into flour of mustard to be used as a condiment. By afterwards distilling the marc with as much water as will prevent empyreuma, a pale-yellow volatile oil is procured: its sp. gr. is 1.0387. It has a pleasant odour, and an acrid, burning taste. It is slightly soluble in water, but very soluble in alcohol and ether. It has been proved that this volatile oil is not a constituent of the seeds of Black Mustard, as bruised Black Mustard seeds exhale no odour until they are moistened: this is owing to their containing a principle analogous to emulsion; they also contain a bitter, inodorous substance, Myronate of Potassa, which, when united with this emulsion, or Myrosyne, by means of water, at a temperature of 90° Fahr. forms the volatile oil, on which the activity of the black mustard seed depends, and which requires the presence of water for its development*. If the seeds be triturated with lime, ammonia is exhaled; probably owing to some decomposition taking place, which yields hydrogen to combine with the nitrogen of their oil†.

Notwithstanding the stimulant property of mustard, it is astonishing how much the stomach resists its action. In moderate doses, as a condiment, it is a wholesome Excitant; in a weakened condition of the stomach, it rouses its sensibility, and promotes chymification: in large doses, however, it interrupts digestion, and irritates the nervous system. Van Swieten relates the case of a strong healthy man, attacked with a quartan ague, who swallowed a large quantity of bruised mustard-seeds steeped in hollands: inflammatory fever followed and carried him off in three days‡; but it is probable that the hollands was more deleterious in this case than the mustard. In intermittent fevers, however, the union of the exciting influence of the Mustard with tonics has proved highly beneficial.

Callisen advises the combination of Mustard and Cinchona in the low stage of typhus§: its utility is manifested by a gentle perspiration, an increased secretion of urine, and an abatement of delirium: occasionally, it causes vomiting||.

* The Volatile Oil consists of—

Carbon	49.84	or 16	= 192.96
Hydrogen . . .	5.06	10	= 10.00
Oxygen . . .	10.18	$2\frac{1}{2}$	= 20.00
Nitrogen . . .	14.41	2	= 28.30
Sulphur . .	20.48	$2\frac{1}{2}$	= 40.25
	100.00	Equiv.	291.51

† Journ. de Chim. Med. tom. i.

‡ Commentaries, vol. ii, p. 30.

§ Acta Soc. Med. Hafn. tom. i, p. 364.

|| Acta. Reg. Societat. Med. Hafn. tom i, p. 364. The mania of swallowing large quantities of white mustard seed, which prevailed in 1826, has, like other empirical manias, disappeared. The practice, however, was not peculiar to that time.

The only officinal preparation of Mustard is the Mustard Cataplasm.—(See RUBEFACIENTS.)

f. ALKALOIDS.

These are organic compounds, which, in combination with acids, are deposited in the barks and the seeds of many plants. They possess alkaline properties*; and consist of Carbon, Hydrogen, Oxygen, and Nitrogen. They are readily decomposed by heat; and ammonia is a constant production of their destructive distillation. They are sparingly soluble in water and in cold alcohol; very soluble in boiling alcohol, but they separate in crystals as the solution cools. Those which demand our notice as officinal Excitants are Veratria, Strychnia, and Brucia.

* *From Roots and Seeds.*

VERATRIA.

This alkaloid was discovered by Pelletier and Caventou in 1819; and it now holds a place in the Edinburgh and the London Pharmacopœias, although it is rarely employed in its separate state. It is seldom found perfectly pure in the shops: but is generally in a pulverulent form, of a dirty-white colour, inodorous, and having an extremely bitter taste. When boiled in alcohol, and digested in animal charcoal, it is procured white, but still pulverulent and uncrystallized. In this form, it requires 1000 parts of water for its solution; is very soluble in alcohol, and soluble, but less so, in ether. It has an alkaline reaction, and forms neutral salts with acids. Impure Veratria is reddened by nitric acid; but the pure forms with it a yellow solution: strong sulphuric acid gives it an intense red colour. With diluted sulphuric acid and hydrochloric acid it forms crystallizable salts. According to the analysis of Couerbe, Veratria is a compound of—

Carbon . .	34	=	208.08	or	70.786
Hydrogen . .	22	=	22.00		7.636
Nitrogen . .	1	=	14.15		5.210
Oxygen . .	6	=	48.00		16.368
	Equiv.	=	293.23		100.000

Veratria was supposed to be the active principle of Colchicum *autumnale;* but the alkaloid in Colchicum has been ascertained to be of a distinct character, and named by Geiger and

* Sertuerner, a German, first discovered the mode of obtaining these substances in a separate state, in 1808.

Hesse, its discoverers, *Colchicia.* Veratria may be procured from the rhizome of Veratrum *album,* or the seeds of Veratrum *Sabadilla,* Helonias *officinalis** ; but it is the seeds of the last-mentioned that are ordered by the London and the Edinburgh Pharmacopœias. The process of the Edinburgh College is the most economical; but that of the London College is the most productive. In the latter, the Gallate of Veratria, in which form the alkaloid is contained in the seeds of Sabadilla, is taken up by rectified spirit, and an extract which is thus procured is treated largely with diluted sulphuric acid, by which the gallate of Veratria is converted into a sulphate. This is then decomposed by Magnesia, and the washed precipitate being digested in fresh spirit of wine, and the spirit distilled off, the residue is boiled in water containing animal charcoal, or acidulated with sulphuric acid, by which a purer sulphate than the first is procured, and this being decomposed by ammonia, the Veratria is precipitated. It is still, however, impure, and requires to be purified as already stated†.

The influence of Veratria on the animal œconomy is that of a powerful excitant, whether it be applied topically or taken into the stomach. In repeating the experiments of Magendie, and injecting it into the pleura of a dog, it induced tetanus which terminated fatally in five minutes; when introduced into the stomach, it excites vomiting, inflammation of the organ, and vertigo. The effects which follow its application or its administration in men are similar. When applied to the skin in the form of ointment, it causes at first a sensation of cold, which is followed by heat and tingling, not confined to the part to which the ointment is applied, but felt, also, in different and distant parts. When largely diluted with starch and snuffed up the nostrils, it excites violent sneezing, and a copious discharge from the nostrils, which continues for several days. When administered internally, in doses of an eighth or a sixth of a grain, it excites at the epigastrium a sensation of heat, which gradually extends over the body, accompanied with a slight formication of the surface, and sometimes with nausea and vomiting. It occasionally affects the glandular system, causing salivation, diuresis, and an augmented flow of bile.

The dose of Veratria should not exceed the eighth of a grain at first. The best mode of administering it is in pills.

The influence of Veratria is modified by combination in the parts of the plants which yield it. The first is—

WHITE HELLEBORE ROOT. *Veratrum.* L. *Veratri Rhizoma.*

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* I mention both of these plants because Dr. Lindley, on the authority of Schiede and Deppe, informs us the Sabadilla seeds of the shops are a mixture of the seeds of both plants. Flora Medica, p. 586.

† For the details of the processes of the two Colleges, see their Pharmacopœias. For Couerbe's process, Ann. de Chim. et Phys. tome lii, p. 190.

E. *Veratrum album. Radix.* D.—It is extremely difficult to determine whether this plant be the Hellebore of Dioseorides* and the aneients. It is found abundantly on alpine situations in the South of Europe and Greeee; and it is occasionally eultivated in this eountry as an ornamental plant. It belongs to the natural order *Melanthaceæ*†. The roots are attaehed to a nearly horizontal rhizome, about the thickness of the human thumb, præmorse, wrinkled, of a blackish-brown hue externally, and whitish within. The rootlets originate in a ligneous ring, whieh is seen in the transverse section of the rhizome, covered by a eompaet epidermis. The stem rises from one foot and a half to four feet in height; the lower leaves are sheathing, large, broad-ovate; the upper narrower, all sessile and longitudinally plaited. The flowers are in a terminal panicle, of a yellowish-white eolour, green at the back, and polygamous.

The dried rhizomes are nearly inodorous; their taste bitter and extremely aerid. Aeeording to the analysis of Pelletier and Caventou, they contain *an acid, fatty matter* (consisting of stearine, oleine, and a volatile acid), *acidulous gallate of Veratria, a yellow colouring matter, fecula, gum,* and *lignine*‡. The deeoetion of the rhizome strikes a deep blue with Iodine; an olive-green with sesquichloride of Iron; becomes turbid with tineture of Galls; and throws down eopious preeipitates with the aeetates of Lead.

The rhizome of White Hellebore operates as a violent aerid exeitant in whatever manner it is applied to the habit or administered. When the powder, even diluted with stareh, is snuffed up the nostrils, it excites violent sneezing, and a eopious diseharge from the nostrils; undiluted, it causes epistaxis; and rubbed upon the skin, inflames and operates as a powerful exeitant; and when applied to the abdomen, causes vomiting§. Taken into the stomach in moderate doses, it excites both the vaseular and the nervous systems, augmenting the secreting aetion, and also that of the eutieular exhalants. In full doses, namely, from eight to fifteen grains, it eauses vomiting, purging, sometimes of bloody stools, eolic, tenesmus, and great depression of strength. In larger doses, it is a violent narcotieo-aerid poison, causing all the above-mentioned symptoms in an augmented degree, with a sensation of constriction of the throat, faintness, tremors, giddiness, dilated pupils, blindness, loss of voice, cold sweats, convulsions, and death. In medium doses, its use is sometimes followed by an eczematous eruption.‖

* Ελλέβορος λευχὸς.

† Woodville's Med. Bot. third edit. p. 753, t. 257. Richard, Hist. Nat. Med. i, 358. Lindley, p. 585

‡ Ann. de Chim. xiv, p. 81.

§ Etmuller.

‖ No decided antidote has been discovered for the poison of White Hellebore; consequently, after evacuating the stomach, the cases must be treated on general principles

White Hellebore has not been much administered internally. It was supposed to be the active constituent of the *Eau Medicinale*, by Mr. James Moore, who proposed it, in combination with laudanum, as a substitute for that nostrum in gout*. Its chief employment has been as a topical application, either in the form of decoction, or an ointment made with the powder (two parts of the powder to eight of lard), in scabies, and for the destruction of pediculi: or the diluted powder (grs. iii and powdered starch grs. ix) as an errhine in amaurosis. Neither the decoction nor the ointment should be applied to an abraded or a denuded surface.

The officinal preparations of White Hellebore are a decoction†, a wine‡, a tincture§, and an ointment||.

Sabadilla Seeds. *Sabadilla.* L. E.—These seeds are stated, in the London Pharmacopœia, to be those of Helonias *officinalis* of Don¶: but Dr. Lindley** mentions, on the authority of Schiede and Deppe, that the seeds of the plant, which is thus named, furnishes a portion only of the Sabadilla seeds of the shops, the greatest part being supplied by Veratrum *Sabadilla.* The former plant is a native of Mexican Andes, near Barranca de Tiosel; the latter of Mexico and the West India Islands: both belong to the natural order *Melanthaceæ.*

The Helonias *officinalis* is a much smaller plant than Veratrum *album*, with long, carinated leaves, resembling a grass. They are sometimes four feet long, whilst the scape rises six feet, and bears a variety of flowers on a panicle one foot and a half long. The flowers smell like those of the common Barbary: are white, bractiated, bisexual: the fertile flowers being below, and the male and sterile above. The seed-vessels are follicles, three together, papery, and acuminate. The seeds are imported in the follicles, which are about half an inch long, of an oblong-ovate shape, and of a pale yellowish-brown colour. The receptacles and pedicels are present, and many of the follicles empty. The seeds are curved, pointed, corrugated, slightly winged, and of a shining dark-brown colour. They yield their active principle to water, affording an acidulous decoction, the colour of which is deepened by alkalies and weakened by acids. Salts of Iron throw down an olive-brown precipitate; and precipitates are also caused by sulphate of Copper, nitrate of Silver, the acetates of Lead, and oxalate of Ammonia. Tincture of Galls and Iodine cause no change, in which respect Sabadilla seed differs from the rhizome of Veratrum *album.* Pelletier and Caventou found the same constituents in them as in the rhizome of Veratrum *album.*

* See Two Letters to Dr. Jones, by Jas. Moore, 1811.
† Decoctum Veratri. L. D
‡ Vinum Veratri. L. Dose, m. x.
§ Tinctura Veratri. E. Dose, m. v.
|| Unguentum Veratri. L. D.
¶ Edin. New Phil. Journ. Oct. 1832, p 231.
** Flora Medica, p. 586.

The physiological influence of Sabadilla on the animal œconomy scarcely differs from that of the rhizome of White Hellebore. As an excitant, it is seldom used, except for its topical influence, which is similar to, and depends on, the Veratria it contains. There is no officinal preparation of it; and its chief use is for obtaining Veratria.

Although Veratria is a decided Excitant, yet it has been chiefly employed as a narcotic in neuralgic and spasmodic affections; but, as Dr. Paris has justly remarked, "it requires a more extended experience to establish its claims to our regard*;" and its virulence of action is such as to demand the utmost caution in its administration.

STRYCHNIA AND BRUCIA.

STRYCHNIA. *Strychnia*, L. E. was discovered by Pelletier and Caventou in 1818†. It exists in the fruit of the Strychnos *Nux vomica*, that of Strychnos *St. Ignatia*, Strychnos *Colubrina*, and *Upas Tieute*. The S. *nux vomica* is the officinal plant of the British Pharmacopœia. It is a tree, a member of the natural order *Apocynaceæ*, a native of the islands of the Indian Archipelago and Ceylon, the coast of Coromandel, Cochin China, and several other parts of the East Indies, where it is known by the name of *Caniram*, and *Koochila* in Bengal. The seeds, from which the Strychnia is procured, are immersed in the pulp of a berry, the size of an apple, covered with a hard shell. The seeds are flattish, depressed in the centre on one side, and convex on the other; covered on both sides with a velvety down, and containing a horny, semi-transparent perisperm, which encloses an embryo, and consists of a bipartite albumen‡.

All the parts of S. *nux vomica*, the root, wood, bark, and seeds, are extremly bitter; and, more or less, contain Strychnia§; but it is from the seeds that this active principle has been extracted. It exists in combination with a peculiar acid, the Igasuric or Strychnic. One pound of seeds of Nux Vomica, well managed, should yield 34 grains of pure Strychnia; the same quantity of the Bean of St Ignatius, properly treated, should yield 102 grains. Besides the Igasuriate or Strychnate of Strychnia and Brucia, the other components of *nux vomica* are— 2, a *yellow colouring matter;* 3, *Wax;* 4, a *concrete oil;* 5, *gum;* 6, *starch;* 7, *bassorine;* and 8, *lignine*. The rasped seeds have an intense bitter taste, and a peculiar odour somewhat re-

* Appendix to the Pharmacologia, eighth edition.

† Mem. sur un Nouv. Alkali Veget. trouvé dans la fève de Saint Ignace, &c. &c.

‡ See Woodville's Med. Bot. third edit. p. 222, pl. 79. London Dispensatory, art. Strychnos. Richard, Hist. Nat. Med. tom. ii, p. 146. Lindley, 528.

§ The bark is supposed to be identical with that well known in commerce by the title of false *Angustura* or *Cusparia;* but on this point I am still sceptical.

sembling that of liquorice. Sulphuric acid chars the powder, nitric acid changes it a deep orange-red colour, owing to the Brucia which it contains. The seeds yield their active principle sparingly to boiling water, but abundantly to alcohol. The decoction is precipitated whitish by diacetate of lead; green by the sulphates and the sesquichloride of iron; emerald green by sulphate of copper; and opaline by infusion of gall-nuts. The gall-nut precipitate, which is again dissolved at a temperature of 120° Fahr. is a tannate of starch. Nitrate acid communicates a red hue to the decotion; and Iodine a brownish-yellow, which soon disappears.

There are various methods of obtaining the Strychnia. The most economical process is to macerate the rasped seeds in successive portions of cold water; next to evaporate the pressed infusion to the consistence of a syrup, and throw down the gum by alcohol. The tincture, thus formed, is next to be evaporated in close vessels by the heat of a water bath: a yellowish-brown coloured extract is left, which is to be dissolved in cold water, to remove a little fatty matter; and the Strychnia is lastly to be precipitated by milk of lime from this solution heated, and afterwards taken up by alcohol. The Igasurate of Strychnia is thus decomposed, and the Strychnia obtained by crystallization. It is, however, seldom procured in a pure state by this process, being generally associated with *Brucia*, which is rendered evident by a blood-red colour communicated to the salt by nitric acid. It may, however, be effectually purified by maceration in diluted alcohol.

Strychnia is procured also by precipitating a strong infusion of the seeds with diacetate of lead, which leaves the Strychnia and Brucia in solution as acetates, mixed with some undecomposed acetate of lead, which can be easily separated by sulphuretted hydrogen gas. The fluid is then to be filtered, boiled to expel the superabundant sulphuretted hydrogen, and magnesia added in excess: this decomposes the acetates of Strychnia and of Brucia, and forms a soluble acetate of magnesia, whilst the excess of magnesia carries down with it the nearly insoluble Strychnia and Brucia. This precipitate is next to be well washed with cold water, and, when nearly dry, to be treated with boiling alcohol to separate the alkaloids. The alcoholic solution, filtered whilst boiling hot, is to be evaporated to dryness, and the extract macerated in weak alcohol, which takes up the Brucia and the colouring matter, and leaves the Strychnia in a pure state, but not crystallized. By re-dissolving it in boiling alcohol, and leaving it at rest to cool, the alkaloid is crystallized*.

* The process of the Pharmacopœia is too expensive, owing to the large quantity of rectified spirit which it requires.

When pure, Strychnia exists in the form of minute, elongated, tetrahedral, prismatic crystals, terminated by a pyramid: but, when it is rapidly crystallized, it is in a granular form. It is inodorous, and is so intensely bitter, that one grain of it gives a perceptible bitterness to eighty pints of water. Strychnia is scarcely soluble in water, requiring 6667 parts of that fluid, at 50° Fahr. for its solution, and 2500 parts of boiling water. It is not very soluble in ether, nor in cold alcohol; but it is very soluble in boiling alcohol, and in volatile oil at 60°. Strychnia is unalterable in the air; but, when exposed to heat, it first melts, then swells, becomes black, is decomposed, and furnishes ammoniacal products. It is seldom procured free from Brucia; but this may be removed by maceration in diluted alcohol. Its purity is easily known by testing it with nitric acid, which colours it red if Brucia be present. If it is required to ascertain the quantity of Brucia, the specimen of Strychnia must be mixed with hot water in a glass tube, and any acid added until the solution be complete; the solution is then to be boiled, and whilst it is boiling the Strychnia precipitated with Ammonia. If the Strychnia be pure, the precipitate will be pulverulent; if it contain Brucia, that salt will adhere to the sides of the tube. By weighing the tube before the experiment, and after the powdery precipitate is washed out of it, the quantity of Brucia thus adhering is indicated by the excess of weight.

Like the other vegetable alkaloids, Strychnia combines with acids, forming crystallizable soluble salts*. The Igasuric or Strychnic acid, with which it is united in *Nux Vomica*, is characterized by precipitating ammoniaco-sulphate of copper emerald-green. The salts of Strychnia are precipitated white by the oxalates and tannates of alkalies; as, for instance, the oxalate of ammonia, and the tannate of potassa.

Besides combining with acids, Strychnia unites with iodine, forming very important compounds in a medicinal point of view.

According to the experiments of Pelletier, and those of Liebig, Strychnia is an azotized product, consisting of—

	Pelletier and Dumas.	Liebig.		
Carbon . . .	78.22	76.43 or	30 =	183.60
Nitrogen . .	8.92	5.81	1 =	14.15
Hydrogen . .	6.54	6.70	16 =	16.00
Oxygen . .	6.32	11.06	3 =	24.00
	100.00	100.00	Equiv.	237.75

* There are two sulphates—1, *neutral*, which crystallizes in cubes, and dissolves in ten parts of cold water; 2, a *bisulphate* in acicular crystals. Two nitrates—1, the *neutral* in pearly needles, grouped in stars; 2, a *binitrate* in very fine acicular crystals. A *hydrochlorate* which crystallizes in tetrahedral needles.

The Igasurate of Strychnia, as it exists in the plants which contain it, consists of three atoms of Strychnia and two atoms of acid.

Brucia, when separated from Strychnia, is procured either in granular powder, or in oblique, four-sided prisms, which are soluble in 850 parts of cold and 500 of boiling water. It is very soluble in dilute alcohol, but insoluble in ether and fixed oils, and sparingly soluble in volatile oils. Its taste is less bitter than that of Strychnia. It is distinguished from Strychnia by tinging nitric acid a deep blood-red colour, passing gradually into yellow, which, on the addition of protochloride of tin to the solution, changes it to a beautiful violet. It consists of Carbon 33, = 201.96, + Hydrogen 18, = 18, + Nitrogen 1, = 14,15, + Oxygen 6, = 40, making the equivalent 274.11.

The Igasurate of Strychnia and the gallate of Brucia are the active principle of Nux Vomica: the following remarks, therefore, may be regarded as applicable to Strychnia and Brucia, both in their combined state in Nux Vomica, and in their separate or pure state.

Strychnia and Brucia in all their forms, pure or combined, are powerful Excitants, displaying their influence topically by a hot pungent sensation when applied to an abraded surface. As general excitants, they first increase the energy of the whole system; and, next, influence chiefly those tracts of the Medulla spinalis which give origin to the motor nerves, causing tetanic convulsions. The nerves of sensation, however, are also involved in this action; for, along with the muscular contractions and convulsions which supervene, the surface of the body is so morbidly sensitive, as to be susceptible of the slightest impressions: even the motion of the air becomes a source of uneasiness, nearly as considerable as in hydrophobic cases*. Before any twitchings or

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* This effect on the nerves of sensation is most remarkably displayed in reptiles; and, as it was particularly demonstrated in the following experiments, I trust I shall be excused inserting them in this note.

May 30, 1832.—An incision was made near the spine of an ordinary green snake, about eight inches from the tail, and one grain of powdered Strychnia rubbed into the wound. The part oozed out only a little blood. The reptile was strong and lively. For nearly an hour afterwards it seemed little disturbed; but, after that time, it became extremely irritable; hissing and rearing itself as if about to strike at any one who attempted to touch it, and moving about with a restless, anxious movement. In three hours it became irregularly convulsed four or five inches above and below the wounded part: it then lay still, except on being touched, when the convulsions were immediately renewed. At the termination of eight hours, the tail had become nearly insensible; and, even when pinched severely, scarcely moved: the greater part of the body was also now insensible. The head and neck, to the extent of ten inches, remained morbidly sensitive; and, for four hours, this sensibility was so great that the convulsions which affected the head and neck were excited by merely blowing the breath upon the animal or agitating the air near it. Dr. Marshall Hall, who witnessed this part of the experiment, satisfied himself of this effect of agitating the air by interposing a pane of glass between the animal and his mouth, and then blowing upon it: no convulsions supervened. The slightest noise also caused a renewal of the convulsions. At this time the head and neck were convulsed every minute; the convulsions continuing for the space of fifteen seconds, then ceasing for four or five seconds, and again recurring for three successive times; after

tetanic convulsions are excited during the administration of Nux Vomica, or Strychnia, or Brucia, sensations of heat, prickings, formications, and other uncomfortable feelings, are felt in the limbs. Neither these sensations nor the irregular muscular actions proceed with an unvarying intensity; they increase at one moment and subside in the next, keeping pace, as it were, with the changes which supervene in the intensity of the irritations impressed on the medullary matter of the spinal cord.

On the stomach, the first obvious effects of the administration of Strychnia, in any form, in moderate doses, is an increased energy in the digestive powers; the appetite improves, assimilation is better effected, and the person becomes fat, more healthy in appearance, and stronger. In large doses, it operates first as a topical irritant, causing heat at the epigastrium and sometimes nausea and vomiting. Although the circulation is not perceptibly affected, yet, if the dose be large, the respiration soon becomes oppressed, the respiratory muscles suffer a clonic contraction, and the person feels as if about to be suffocated. The urinary organs are little influenced; but the cutaneous system, besides the increased susceptibility of impression already noticed, has its capillary vessels also powerfully excited, and copious perspirations occur during the operation of Strychnia.

Such are the physiological effects of Strychnia. When given in large doses, its direct action upon the origin of the motor nerves is evident; first, from the nature of the symptoms that follow—for instance, violent tetanic convulsions, rigidity of the voluntary muscles, as well as those of respiration, thence immobility of the chest, and consequently the deficiency of the decarbonization of the blood; and, secondly, from the evidence afforded

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which the animal would remain still for the remainder of the minute. These convulsions were preceded by a sudden expiratory effort, expressed by a low, hissing sound, which continued for three or four seconds; when the head was raised from the ground, and rapidly moved in a laterul direction. At the termination of twelve hours from the insertion of the Strychnia, the convulsions became less frequent, recurring only once in several minutes; but the sensibility was still morbidly acute.

May 31.—The upper part of the body was now very languid; and convulsions occurred only when the reptile was touched: the tail had, however, recovered its sensibility, and moved briskly when touched near the spot where the Strychnia was inserted.

June 1.—Every thing continued nearly in the same state as yesterday. Wishing, therefore, to shorten the sufferings of the animal, a quarter of a grain of pure Strychnia was introduced about four inches from the head. Soon afterwards, the irritability and liveliness of the reptile returned; but, after an hour, it gradually subsided; and, on the following day, the snake was found firmly coiled up and apparently dead in every part. On the following day, however, the animal was still alive at the head; but the tail and the body had been perfectly dead, from the tip of the tail upwards, for the last twenty-four hours. The head and about six inches of the body moved; but the lower part of it was completely motionless. On the following morning, June 4th, the snake was found completely dead.

The same morbid susceptibility of the surface was observed in experiments on three frogs, a toad, and two newts. For some time the influence of the poison was manifested only on the side of the reptiles into which it was inserted. In the newts, the wounded side was completely dead, whilst the animal was yet able to swim with the other side. How far this effect is to be ascribed to some peculiar disposition of the nervous system in these reptiles, I am not prepared to decide.

by an experiment of Fœderé, who found that, on exposing the spinal marrow in an animal to which Strychnia had been given, he could arrest the convulsions by pressure on the anterior segment of the spinal cord. Experiments have also ascertained the fact, that Strychnia produces no effect upon the system when the spinal marrow has been previously destroyed: but the division of the cord and its separation from any connection with the brain does not weaken its action. That the brain is, however, secondarily affected is evident, from the anxiety, stupor, vertigo, tinnitus aurium, and wakefulness which it occasionally causes*.

M. Delile and M. Majendie maintain that the influence of Strychnia is not communicated through the nervous system, but that the poison is absorbed and conveyed by the blood to the spinal column, on the anterior nerves of which its immediate influence appears to be exerted. There is much plausibility in this opinion; but, reflecting on the effect of the Tincture of Iodine, which acts as an antidote to the poison of Strychnia, by changing the nature of the poison as it exists in the stomach (for we cannot suppose that the change induced, which is of a chemical nature, is likely to take place after the poison has been absorbed), and also on the additional fact, that the influence on the poison is suddenly checked if the stomach can be emptied by a powerful emetic—the theory of these distinguished physiologists is not free from doubt. Still, however, there are many circumstances connected with the action of Strychnia which favour the idea of its absorption—especially its influence being in the ratio of the absorbing property of the surface to which it is applied; thus it acts with most rapidity and energy when applied to a wound, or to the pulmonary surface; with less, when introduced into the stomach; and least when applied to the skin. On the contrary, I have found that it is as long before it operates when it is ejected into the viens, as when it is introduced into the stomach.

Before noticing its therapeutical employment, it may prove useful to take a passing view of the effects which it has produced upon the lower animals: for by having a complete knowledge of the power of any medicinal agent, when the dose is carried to its utmost limits, we are enabled to reason more correctly upon its powers, and to avoid errors in practice which could only be learned after events that are always to be regretted have occurred, and which might be prevented by studying the effects of the medicine upon quadrupeds.

When dogs swallow from twenty to thirty grains of powdered Nux Vomica, they are quickly attacked with all the symptoms of tetanus, distension of the limbs, tremors, convulsive movements of the face and eyelids, immobility of the eyes, and a complete rigidity of all the muscles of the body. There is, also,

See Baly in Brit. and Foreign Med. Review, vi. p.

an involuntary emission of urine. The convulsions are renewed by sudden noise or the slightest touch; but there is no delirium; and, if we may speak of the mind of a dog, the mental faculties remain entire. Many other animals, cats, rats, foxes, and some birds, are similarly effected: but some animals—hogs, for example, and goats—eat the Nux Vomica with impunity. M. Desportes found that it produces very little effect upon poultry.

Desportes, Delile, and Majendie, applied the Nux Vomica and its extract to wounds, and to mucous and serous surfaces. M. Delile injected a solution of twelve grains of the extract into the pleura of a dog: tetanus supervened in less than a minute, and the animal soon died. Applied to wounds, it produced the same effect: but no convulsions followed when it was applied to the sound skin. One grain and a half of the resinous extract were smeared on a small piece of wood, and a dog wounded with it in the thighs: tetanus supervened in seven minutes, and proved mortal in five minutes after the first attack. Introducing the watery decoction of Nux Vomica into the circulation, by injecting it into the jugular vein, produced immediate tetanic symptoms, which rapidly proved fatal. Post-mortem examinations did not display any inflammatory appearances in the stomach; yet the poison has always been found in the stomach or duodenum. One appearance, however, invariably presents itself, whatever may be the surface to which the poison is applied: that is, there is a general contraction of the whole arterial system, which is so obvious in the large vessels, that, in my experiments with Strychnia, I have found the aorta of a strong dog reduced in diameter to the size of a crow quill; and black blood in all the arterial cavities.

Nux Vomica, its extract, and Strychnia, produce the same effect on man as on quadrupeds. This fact is of importance in two points of view: it leads us to be guarded in the administration of these substances, when their exciting influence only is required; and it enables us to take advantage of even their deleterious properties, and to turn them to account in the cure of diseases. In doses of from two to three grains of the powder, or from gr. ss to grs. iv of the Extract of Nux Vomica, prepared according to the formula of the Dublin College, or from one tenth to one eighth of a grain of Strychnia, or half a grain of Brucia, these substances cause some degree of nausea, a sensation of weight at the epigastrium, and occasionally colic, and irritation at the anus; symptoms which are followed by weight in the head, giddiness, pain of the eyes, a sensation and pricking in the urethra, prostration of strength, and apathy; and if the dose be carried beyond those above stated, tetanic convulsions supervene. But different individuals are differently influenced by Nux Vomica and its salts; consequently it is not easy to pronounce what dose will cause tetanus.

Strychnia is a more powerful topical excitant than Extract of Nux Vomica. Applied to ulcers, it causes a sensation of burning, and augments suppuration.

Brucia operates on man in the same manner as Extract of Nux Vomica and Strychnia, but less energetically than the latter. It is seldom used; and is not officinal in the British Pharmacopœias.

The physiological influence of Nux Vomica, Strychnia, and Brucia, led to their employment as remedial agents.

Accidents, and a variety of circumstances, evidently affecting the spinal cord, early demonstrated the fact that paralysis of the lower extremities, Paraplegia, may occur without any affection of the brain; and led pathologists to refer this disease, under all circumstances of its occurrence, to some morbid change, or impression on the motor tract of that organ. It is not necessary, for our purpose, to enter into a discussion of the argument whether it is ever produced by diseased impressions on the brain itself—an opinion which was entertained by Dr. Baillie and Sir James Earle, and is still maintained by several distinguished physicians; and which, if it be correct, does not affect our position, that some morbid change or impression on the anterior portion of the spinal cord is the most general cause of Paraplegia, or palsy of the lower extremities. But it is often, also, induced by powerful sedative impressions on the extremities of the nerves supplied to the intestinal canal; as, for instance, in painter's Colic by the carbonate of lead taken into the stomach. This kind of palsy is cured by Strychnia, and it affords another proof of the truth of the opinion, that this alkaloid operates through the medium of the intestinal nerves. Supposing Paraplegia, therefore, to depend on a paralysis of the anterior nerves of the spine, without softening, or any organic lesion of the cord itself, and knowing the influence of Nux Vomica on this set of nerves, Dr. Fouquier, of the Hospital de la Charité in Paris, was induced to try its effects as a remedial agent in this disease. He administered it both in the form of powder and in that of extract with decided advantage. In the dose of gr. ii of the extract, it sometimes produced contractions in the paralysed muscles, more or less permanent: sometimes these were sudden and transient; at other times they were more slowly induced, and many doses of the extract were required; but a more permanent effect was the result. It is a curious fact, first remarked by M. Fouquier, that the paralytic parts appear always more sensible to the action of Nux Vomica and its salts than the sound parts.

The success of M. Fouquier's treatment induced physicians in different parts of Europe to try Strychnia; and, from the whole of the experience recorded, although mischievous effects have occasionally resulted from its injudicious and indiscreet employment, yet, there is ample authority for regarding it as a

most valuable Excitant in palsy of the lower extremities. As far as my own experience authorizes me to form any conclusions on this subject, I am disposed to regard Strychnia, or the Extract of Nux Vomica, chiefly useful in those cases of palsy which proceed from sedative impressions on the intestinal nerves; such, for example, as occur when carbonate of lead is taken into the stomach; and, indeed, in every case of palsy of the motor nerves only, which is readily known by the sensibility of the paralytic limb remaining after the power of motion is lost, and by the entire state of the sensorium commune, it may prove beneficial.

Much of the contradictory opinions, respecting the value of Nux Vomica and Strychnia in palsy, have originated in the indiscreet administration of it. When softening is present, they are likely to augment that, and consequently to confirm rather than to remove the paralysis. The same results are likely to follow their employment, when inflammation of the cerebral meninges or the theca of the spinal cord is present. In cases, however, in which effusion has taken place, and in which paralysis remains after the clot has either fairly settled, or has been absorbed, Nux Vomica or Strychnia may again awaken, as it were, the dormant sensibility and power of motion in the paralyzed members or regions of the body.

Besides proving useful in paraplegia, they have been found beneficial in other varieties of palsy*. Thus the Extract of Nux Vomica has been advantageously given in rheumatic paralysis, in doses of half a grain every night and morning, until three grains were taken for a dose. The result is, as usual, involuntary movements, attended with pain; but, on these ceasing, the power of volition generally returns by degrees to the limb affected, and

* The following case is one among many which might be selected to illustrate the action of Strychnia in paralysis: Mrs. R. a widow lady, aged seventy, of a spare habit, and delicate frame of body, was attacked, in November 1830, with hemiplegia of the right side of the body. She was attended by a respectable general practitioner, by whom she had been very judiciously treated prior to my advice being requested. I found that Mrs. R. had lost the power of motion in the whole of the right side of the body; the mouth was drawn to the opposite side of the face; the upper eye-lid on the affected side was depressed; and the articulation was so much impeded, that her answers to my questions were scarcely intelligible. The sensibility, however, of the paralyzed side was entire, and its temperature not lowered; the pulse was quick, but feeble; and although the bowels were torpid, yet, they answered to the stimulus of purgatives; whilst the bladder performed, naturally, all its functions. After freely evacuating the bowels, the acetate of Strychnia was prescribed, in doses of one sixteenth of a grain, to be continued at intervals of six hours, and the dose gradually increased until it amounted to a quarter of a grain. In a few days after the administration of the acetate had been commenced, the patient regained the power of raising the arm at the shoulder joint; in ten days she could move the affected leg; the drawing of the mouth disappeared in this time, and she articulated her words distinctly: in three weeks she could use the fingers of the paralyzed hand: and, in another week, she was able to walk about the room with the assistance of a servant After the tetanic convulsions occurred, and the medicine was discontinued, she improved so rapidly that she was able, before the end of December, to get into her drawing room; and, before February the 21st, 1831, she walked out, and had nearly as much voluntary power over the muscles of the affected side as she ever enjoyed.

the patient is able to walk in three or four weeks. It must, however, be acknowledged, that Strychnia has failed in many cases of this description, and that even although it has frequently greatly relieved cases of hemiplegia, yet it has not always succeeded in completely restoring the lost power of the affected side. I have witnessed the beneficial influence of Strychnia in paralysis of sensation in several instances. In one case, where the disease was confined to one side of the face, and one half of the tongue, that salt, applied to a blistered surface over the part where the facial nerves issue, affected a speedy cure. I have, also, seen it prove useful when topically applied in Amaurosis and paralysis of the eyelid: and in incontinence of urine from paralysis of the sphincter vesicæ.

M. Frisch, a German physician, has affirmed that, in robust persons who are attacked with ague, when the Disulphate of Quina fails, that salt may be rendered efficient by combining it with Nux Vomica. He prescribes from six to ten grains of the rasped seed, mixed with two ounces of Cinchona bark, or with twelve grains of Disulphate of Quina, to be taken in divided doses in the intervals of the paroxysms. Dr. Bardsley supposes that it may prove useful in amenorrhœa; and he has detailed several cases in which its administration was followed by the reappearance of the catamenia in its natural state. Dr. Bardsley ascribes this effect "to the power which the Strychnia possesses of stimulating the vessels of the uterus, and of improving the tone and vigour of the system*." This theory of the beneficial influence of this Excitant in amenorrhœa is not perfectly satisfactory. If the flow of the catamenia is to be regarded as a secretion, an ample supply of arterial blood to the organ must be requisite for the due performance of its functions—an effect not likely to result from the use of Strychnia. At the same time, whatever improves the tone and vigour of the system, must necessarily aid the functions of the uterine organs; and, consequently, we are constrained to admit this view of its influence in effecting the cure of amenorrhœa.

The exciting power of Strychnia, in changing morbid into healthy action in the digestive organs, is well illustrated by its influence in pyrosis. It has also proved useful in chronic diarrhœa and in dysentery; but its efficacy depends on the period of the disease in which it is administered. If given early, and during the continuance of inflammatory action, it is always injurious; but, on the decline of the inflammatory symptoms, by changing the action of the diseased surface, it removes the irritability of the intestinal canal and increases the powers of the digestive organs. M Frisch asserts that no medicine is so efficacious as Nux Vomica in that form of chronic diarrhœa which is kept up by a subacute state of inflammation of the villous coat

* Hospital Facts and Observations, &c. by James Lomax Bardsley, M.D. p. 57.

of the intestines, and which is marked by viscid mucous evacuations and considerable tenesmus. In this complaint, he combines it with small doses of ammonia and mucilaginous drinks, particularly Salap*. These statements are confirmed by the experience of Dr. Belcombe†, Hufeland‡, Hagstrom§, and others. The influence of Nux Vomica on the sexual organs, as an aphrodisiac, induced M. Trousseau to administer it in cases of impotence. In a man who had been three years paraplegic, and had become completely impotent, the powers of virility were restored in a month; and in another, who had been impotent for seven months, they were renewed in fifteen days, by the use of Nux Vomica. In another case the impotence returned after the use of the remedy was discontinued.

A question here presents itself—Does the action of Nux Vomica differ from that of its alkaloids? In reply, I assert that the action of Strychnia and Extract of Nux Vomica certainly differs in one respect, which is not easily explained. Extract of Nux Vomica determines to the head; pure Strychnia and its salts produce scarcely any obvious effect on the cerebral circulation—a fact of great practical importance, as it authorizes us to prescribe Strychnia and its salts in cases where, although paralysis may have arisen from pressure in the brain, yet, there is reason for thinking that, after the exciting cause is removed and paralysis remains, benefit may be derived from the influence of so powerful and direct an Excitant on the nervous system. In cases, however, in which plethora exists, the previous use of the lancet is requisite, to prevent congestion or an over-distension of the venous system likely to result from the powerful contractile influence of the Strychnia on the coats of the arteries. In very few instances I observed that the administration of pure Strychnia, or its salts, has been followed by headache. In one case, symptoms closely resembling those of intoxication supervened on the third day after commencing the use of the remedy, which was repeatedly discontinued, and when renewed it was always attended with a return of this effect. I am disposed to regard this as an instance of idiosyncracy, rather than a result of the medicine likely to occur in others.

From these facts, there is every reason for preferring pure Strychnia, or its salts, or Brucia, which operates exactly as Strychnia, to either the powder or the Extract of Nux Vomica. Various causes, also, may occur to render the powder or the Extract uncertain in its operation; whereas the proper apportioning of the dose of Strychnia to the condition of the patient, and the severity of the case, must always afford a more certain result than we can expect from it when clogged with other vegetable constituents, as in the powder and the Extract, or even the Tincture of Nux Vomica.

* The prepared tubers of Orchis *mascula*.

† Lond. Med. Gaz. vol xix, p. 964.

‡ Bayle's Bibl. Therap. t. ii, p. 136.

§ Ibid, p. 135.

With respect to the mode of prescribing Strychnia, it is necessary to bear in remembrance its great insolubility, and the variation of activity of the salt according to the acescent state of the stomach at the time. The greater the quantity of acid present in the stomach, the more active will the Strychnia prove. To obviate this inconvenience, it may be administered in the form of acetate, which is easily produced by dissolving one grain of pure Strychnia in f℥i of distilled vinegar, so that six minims of this solution contain one tenth of a grain of Strychnia, the dose of the medicine which should be given at first. Such a solution, also, enables the dose to be more gradually increased than can be effected when the medicine is in the state of powder. The sulphate is also a good form of the salt. The extent of the dose to which simple Strychnia has been carried in some instances, can only be explained by the little solubility of the medicine, and the defect of acid in the stomach of the patient. Given in the form of the acetate, I have in no instance been able to carry the dose to the extent to which Dr. Bardsley has carried it: indeed, I have never been able to exceed thirty minims of the solution, a dose equivalent to half a grain of the Strychnia, three times a day. The usual forms, however, of giving Strychnia are those proposed by M. Majendie. He directs grs. ii of the pure salt to be carefully beat up with grs. xxx of conserve of roses, and divided into twenty-four pills, each of which should thus contain one twelfth of a grain of Strychnia. He also orders it in the form of tincture, composed of grs. iii of pure Strychnia dissolved in f℥iss of strong alcohol, so that three minims of the solution contain one tenth of a grain of the salt. The sulphate has been occasionally employed. Brucia may be administered, in the same manner as Strychnia, in doses of half a grain, gradually increased until tetanic twitchings are produced.

Nux Vomica is administered in the form of powder, tincture, and extract. The Powder, although the dose at first should not exceed four grains, yet, it has been carried to the extent of fifty grains a day. The Tincture* is both given internally in doses of m. v to m. x; and is also topically applied to paralysed parts, as an embrocation. Of the alcoholic Extract†, half a grain is at first given at night and in the morning; and one grain is added every day, or every second day, until the specific influence of the remedy displays itself with an intensity sufficient to lead to a salutary result.

With respect to the effects of an overdose of either Strychnia or Brucia, or of the extract of Nux Vomica, the fatal consequences seem to proceed partly from the poison exhausting the irritability of the heart, partly from asphyxia. When it operates as a poison, the first effect is tremor: this is followed by stupor and a sense of intoxication, which is quickly succeeded by general symptoms of tetanus, stiffness of the muscles of the neck, lockjaw, severe

* Tinctura Nucis Vomicæ. D. † Extractum Nucis Vomicæ. E. D.

pain under the ensiform cartilage, violent spasmodic contraction in the intercostal, the lumbar muscles, and those of the whole spine, so as to produce opisthotonos and laborious respiration, complete asphyxia, and death. As, in all cases of poisoning, the first object is to get rid of the offending cause, the second to destroy the virulence of the poison, the use of the stomach-pump or emetics must be resorted to as quickly as possible; after which, tincture of Iodine should be freely administered. This antidote was discovered by M. Donné, who found that the Iodide of Strychnia could be given in doses of gr. iiss to a dog with impunity; whereas gr. ss of Strychnia was sufficient to kill the animal. He therefore tried Iodine as a counterpoison, and gave the tincture of it to dogs to which a grain of Strychnia had been given. In seven cases, one case only resisted the antidote; and in this it was not administered until ten minutes after the poison had been swallowed.

I have had no opportunity of trying this antidote on man, except in one case, in which the tetanic symptoms arising from the employment of Strychia, in a case of paraplegia, were very alarming. The spasms certainly appeared to abate more rapidly than usual; but I cannot positively refer this effect to the use of the Iodine. Its influence, however, in this respect, in quadrupeds, is a strong reason for trying it in man.

When death has been the consequence of an overdose of Strychnia, the post-mortem examinations have displayed scarcely any traces of inflammation even in the stomach; but the venous system of vessels is found to be always gorged with blood, whilst the arterial is nearly empty and contracted.

ALCOHOL.—Syn. *Rectified Spirit of Wine.*

Alcohol is a powerful and most valuable Excitant, both in its *combined* and *uncombined* state. As we must examine it in both, we shall understand it better if we first obtain a correct knowledge of it in its purest form.

Alcohol in its purest state, that which is supposed to be quite free from water and volatile oil*, *absolute* or *anhydrous Alcohol*, has a specific gravity of 0.791, at 62° Faht. It is a limpid, colourless liquid, of an agreeable, penetrating odour, and a hot taste; its fluidity has hitherto resisted every degree of temperature below Zero of Faht.; for, although Mr. Hutton is stated to have frozen it in 1813†, there is, nevertheless, still reason for believing that the fluidity of absolute alcohol resists every known degree of cold, artificial or natural. Pure alcohol is extremely volatile, produces great cold during evaporation, and leaves no residue. It is highly inflammable, its vapour catching fire on the ap-

* To detect this, pure nitrate of silver should be added to the alcohol, and the solution exposed to the sunshine: if it turn red, volatile oil is present.—*Vogel.*

† Nicholson's Journal, vol. xxxiv.

proach of any ignited body, burning with a pale blue flame, and generating a large quantity of water and carbonic acid, without soot. The bluer the colour of the flame, the stronger the alcohol is accounted. Absolute alcohol boils in the open air, at 173° Faht. and in vacuo at 56°. It has a great affinity for water, attracting it from the atmosphere, mixing with it in every proportion, and evolving heat*, owing to the density of the mixed fluids being greater than the mean of the densities of the unmixed fluids. Thus, if alcohol at 796 and water in equal proportions be mixed together, the sp. gr. at 60° Faht. will be 917; but the mean density would indicate only 986. Owing to the same property, it precipitates from their solutions salts which are insoluble in alcohol; but, nevertheless, alcohol combines with chlorides and nitrates, and forms compounds which are termed alcohates, in which the alcohol acts the part of water of crystallization. It is this great affinity for water which enables it to preserve animal matter. According to M. Theodore de Saussure, pure or anhydrous alcohol consists of—

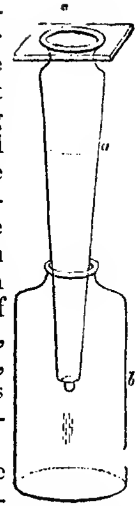
Carbon .	51.98 or	52.17 or	2 equivalents (6×2) =	12.24
Hydrogen .	13.70	13.04	3 equivalents (1×3) =	3.
Oxygen .	34.32	34.79	1 equivalent . . . =	8.
	100.00†	100.00	=	23.24

or 1 equivalent of Olifiant Gas = 14.24 + 1 equivalent of water = 9; = 23.24. But it is also regarded as a Hydrate of Oxide of Ethule‡, making its formula C. 4, H. 6, O. 2, = 46.48.

Alcohol is a solvent of many substances—namely, Iodine, Camphor, Resins, Balsam, Volatile Oils, Castor Oil, Sugar, Manna, Tannin, pure Potassa, Soda, Ammonia, the vegetable Alkaloids, and many other vegetable constituents:—it is therefore much used as a pharmaceutical agent. The alcohol employed by the directions of the London Pharmacopœia is of sp. gr. 815, and contains 93 parts of anhydrous alcohol and 7 parts of water: the rectified spirit, sp. gr. 835, contains 15 per cent. of water.

Strong alcohol is prepared from weaker alcohol, or strong ardent spirit, by adding to it substances which have a stronger affinity for water than alcohol has. The best of these is dried carbonate of potassa. Other substances, such as fused chloride of calcium, which is ordered by the London College in the proportion of 1 lb. for every gallon of rectified spirit of sp. gr. 0.838, which yields seven pints and five fluid ounces of alcohol of sp. gr. 0.815. Quick lime, or dry alumina, may also be employed with advantage. They should be put into a retort in small pieces, and the alcohol of commerce poured over them in

* But snow mixed with alcohol produces intense cold.
† Ann. de Chimie, tome lxxxix.
‡ Ethule is the hypothetical radical of Ether; its formula is C. 4, H. 5.



the proportion of 2 lbs. for every 1 lb. of the substance used. The mixture is then left at rest for some time, and afterwards distilled, removing the product at different periods; the strongest being that which comes over first, and each portion becoming weaker towards the conclusion of the process; until at length, by pushing the distillation to dryness, little more than water is obtained. This process was invented by Richter. The method I employ is more simple: I put the dry carbonate of potassa, in rough powder, into *a*, a long, narrow, glass funnel, or a tin percolater of the same shape, the lower extremity of which is plugged with cotton and placed in the bottle, *b*; the spirit is then poured over the saline matter, and the top of *a* covered with a piece of glass, *c*; as the fluid percolates the mass, its watery part is arrested, and only the strong alcohol passes.

Various means have been contrived to determine the quantity of water contained in different specimens of alcohol: all of them are founded on the same principle; namely, the relative specific gravity of a spirit at a given temperature*. The hydrometer of Beaumé is one of the most convenient instruments for ascertaining this point; but in this country Sykes's is employed. The scale begins with *water*, which is marked 1.0000, and ascends to proof spirit, the sp. gr. of which is 0.9200, below which all spirits are regarded as under proof, and all above it as over proof. Thus, at 0.9259 the spirit is 5 per cent. under proof; and at 0,8259 it is 62 per cent. over proof.

Such is alcohol in its uncombined state. I shall defer noticing its effects on the living system, and its therapeutical uses, until I have examined it in its combined state.

Alcohol exists, in a combined state, in *Ardent Spirits, Wine, Beer, Cider*, and every fermented liquor.

Ardent spirits are combinations of *alcohol* and *water*, flavoured by volatile oils, on the nature of which all the varieties of these spirits depend.

Every vegetable substance which contains sugar, gum, fecula, ferment, or similar principles, when diluted with water and exposed to a certain temperature (70° to 80° Faht.), undergoes fermentation; during which the ultimate components of these principles enter into new combinations, the result of which is the formation of alcohol and carbonic acid. The taste of the sugar has completely disappeared, and a vinous one developed. This is the first stage in the formation of alcohol—the production of

* Another, but a coarse and uncertain, test, called the *Bead*, is usually adopted for common purposes. It consists in shaking the spirit in a phial, and observing the size and the bursting of the bubbles: the larger and more numerous, and the quicker they burst, the stronger is the spirit.

wine, or at least a vinous liquor. According to Thenard, 300 parts of sugar and 60 of yeast = 360, produce, by fermentation, 171.5 of Alcohol (sp. gr. 0.822), 94.6 Carbonic Acid, 12.0 nauseous residue, and 40.0 of residual yeast, = 318.1; making a loss of 41.9 parts. The yeast, the nauseous matter, and loss, being set aside, it appears that the saccharine matter which has disappeared is exactly equal to the combined weights of the alcohol and carbonic acid. Now, if we suppose that three parts of sugar are requisite to form one part of alcohol and one of carbonic acid, the changes may be thus demonstrated:

Sugar . . 3 parts	= 3 Hydrogen	+ 3 Carbon	+ 3 Oxygen	=	45.36
Alcohol . 1 part	= 3 ——	+ 2 ——	+ 1 ——	=	23.24
Carb. Acid, 1 part	= 0 ——	+ 1 ——	+ 2 ——	=	22.12

Or if we take one atom of dried Grape Sugar, the elements of which are C. 12, H. 14, O. 14, we shall find that it contains exactly the elements—

4 of Carb. Acid,	C. 4.	+	O. 8
4 — Alcohol .	C. 8.	H. 12.	O. 4
2 — Water . .	—	H. 2.	O. 2
1 at. Grape Sugar,	C. 12.	H. 14.	O. 14

This transformation is effected by the presence of any body containing Nitrogen in a state of decomposition, or *ferment*. In this view of the case, the whole of the hydrogen, two parts of the carbon, and one of the oxygen, of the three parts of sugar, combine to form one part of alcohol; whilst the remaining one part of carbon and two parts of oxygen united constitute the carbonic acid, which is evolved in the form of gas: or, in other words, the elements of the sugar are divided into two portions; one of which, the carbonic acid, contains two thirds of the oxygen of the sugar and only one third of its carbon; and the other, alcohol, contains the whole of the hydrogen, combined with the residue of the carbon and oxygen: or "Alcohol is Sugar *minus* carbonic acid*." The elements of the body which excites the fermentation take no part in the transformation. Ferment or yeast employed in this case is a substance in a state of decomposition; its influence is communicated to the sugar, disturbs the equilibrium of its constituents, which, grouping themselves in a new order, produce Alcohol.

But, as the Alcohol thus formed is mixed with much water and other ingredients, it is necessary to separate them; the process for effecting which is termed *distillation*. The whole is boiled in close vessels, and the vapour condensed; so that the alcohol, which is more volatile than the water and the other ingredients, is obtained in combination with a small portion of essential or volatile oil, and some water. In this state, the fluid is called *low wine;* by a second distillation the strength is doubled, and it becomes *raw spirits;* and by the repetition

* Daniel's Introduction, p. 317.

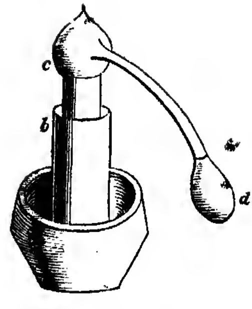
of the process, at a lower temperature, the alcohol is freed from another portion of the water, and then constitutes *ardent spirits*, which are named Arrack, Brandy, Geneva, Rum, Whiskey, and so on, according to circumstances. All of these are modifications of alcohol and water, tinged with colouring matter, and flavoured by some essential oil. The alcohol is the product of the fermentation, and merely separated by the distillation; a fact demonstrated by the experiments of Mr. Brande* and those of Gay-Lussac†. Into wine a quantity of acetate of lead, or of litharge, in fine powder, was introduced, and the mixture agitated until the colour nearly disappeared; after which it was filtered: the colouring matter remained in the filter. Dry and hot carbonate of potassa was then put into the filtered fluid: the liquor divided into two distinct portions, which could easily be separated from one another by decantation. One of these, on examination, was found to be alcohol; thus demonstrating the fact, that alcohol is ready formed in vinous or fermented liquors, and merely separated by distillation from a large portion of the water with which it is combined.

In the rectification of corn spirits, one gallon of volatile oil is procured from 500 gallons of the spirit. It is of a pale yellow colour, limpid, and impresses an unpleasant odour and an acrid taste: but when rectified in chloride of calcium, it is colourless. Its sp. gr. at 56° Fahr. is 0.833. It burns with a yellow flame; is soluble in alcohol, ether, and strong nitric acid, which, by the aid of heat, acts violently with it, giving off nitrous fumes and nitric ether. It is insoluble in liquor ammoniæ and liquor potassæ. It dissolves iodine. Sulphuric acid reddens and thickens it, and evolves the odour of mint. Potassium decomposes it, with the evolution of hydrogen‡.

It does not appear that the process of distillation was known to the Hebrews, or any very ancient people; nor was it known to the Greeks, who, amidst the effulgence of genius which brightened the best period of their history, were utterly ignorant of chemistry. Even the essential oil of pitch, which was collected by them, was procured by spreading the fleece of a sheep over the pot in which the pitch was boiled, and afterwards wringing out the oil collected in the wool. They procured fresh water at sea by suspending large sponges in the mouths of brazen vessels in which the salt water was boiled, and, when the sponges were saturated, they squeezed out the fresh water. This certainly may be regarded as a species of distillation in its rudest state; but it was not until the time of Geber, who lived in the seventh century, that any process which may be justly called *distillation* was known. In the second book of his work, entitled

* Phil. Trans. 1811, 1813.
† Mem. d'Arencill. vol. ii.
‡ Pereira's Elements, p. 196.

"Liber Investigationis Magisterii," some very accurate ideas of distillation are given, with figures of the apparatus. These figures display the rude condition of the apparatus; but they demonstrate that the nature of the process was understood. In the marginal cut, *b* is the body of the still, *c* the capital, *d* the recipient, and *a* the fire-place. It is evident, therefore, that distillation must have been invented before the time of Geber, who merely mentions the process which was



then in use. The progress of improvement was very slow; as the still which was employed at a much later period was nearly the same as that described by Geber. Indeed, it has been pretty accurately ascertained that the *Alembic*, for the purposes of distillation, was invented by the Saracens; and to their efforts in search of the Elixir Vitæ, the world is indebted for the greatest curse, next to war, ever inflicted on the human race—the discovery of ardent spirits.

The art of distillation is now almost universally understood; and ingenuity has been tortured to perfect the *still* and *condenser*, so as to procure a pure spirit at one operation: but it is foreign from our purpose to enter into details respecting these transformations of the Alembic into the perfect Still of the present period.

Ardent spirits are procured from a variety of sources. In Nubia, a spirit called *Bouza* is distilled from barley; in Persia and in Morocco, Brandy is distilled from fermented raisins, and also from the fig, and called *Mahayagh;* in Tartary, a spirit called *Araka* and *Arika* is distilled from fermented mare's milk, or koumiss: in the Mysore, it is procured from *jaggory*, a coarse sugar made from the juice of the Palm. The Burmese and Siamese distil spirits from Palm wine, *Toddy*, as well as from rice and other grain, and call it *Lau.* The inhabitants of Java, Sumatra, China, and the peninsula of India, all distil *Arrack;* and one of the gifts bestowed by Europeans upon the natives of the Sandwich Islands, and many of those of the Pacific oceans, is the art of making Rum, which the natives call *y-wer'a*, literally *hot water*. It is unnecessary to proceed thus with the statement of the kinds of the distilled spirits made in the more civilized countries of the world. I will, therefore, confine myself to a few remarks on the nature of the four ardent spirits most generally drunk in Europe—namely, *Brandy*, *Geneva* or *Hollands*, *Whiskey*, and *Rum*.

*Brandy** is made chiefly from wine; and also from a fluid made by subjecting the *marc* or residue of the pressings of

* The name is of German origin, and implies wine that has undergone the operation of fire—*brandtwine*.

grapes in making wine: but when this is used, the spirit has an acrid taste, arising from an oil resident in the skin of the grape. It is a mixture of various proportions of alcohol and water, flavoured by a volatile oil, which is taken up, in a small degree, during the process of the fermentation of the wine, and rises with the alcohol in the distillation. Brandy is not naturally coloured; but it receives its colour from age: its brownish orange hue, however, is often artificial, and derived from burnt sugar, or caromel, which imparts to the spirit both odour and taste. Dr. Paris supposes that the peculiar flavour of Cogniac depends on the presence of an etherial spirit formed by the action of the tartaric or acetic acid of the wine on the alcohol. He also supposes that newly distilled Brandy contains a quantity of uncombined acid, which disappears by age. This modification of diluted alcohol, in moderate doses further diluted with water, is *cordial* and *stomachic*.

Geneva, or *Hollands*, is distilled from fermented Juniper berries, the fruit of Juniperus *communis*; but more frequently from fermented, malted barley. Rye, coarsely ground, is added to this malt; and, both being mixed with a sufficiency of water, the fermentation is promoted, until the liquor has become transparent, and hot and acrid to the taste; when it is put into the still, and the distillation conducted slowly at first, to prevent the essential oil from rising with the spirit. This crude spirit is then redistilled, or rectified, over juniper berries; and it is from the French term for the Juniper, *Genevre*, that the English names Geneva and Gin are derived. The discovery of Juniper spirit is attributed to Sylvius, a Professor of Leyden, who lived in the middle of the seventeenth century. It was at first sold as a diuretic in the apothecaries' shops; but, as the common people drunk it with avidity, it became an article of trade, and Barley malt and Rye were substituted for the juniper. When properly prepared, it is a pure diluted alcohol, flavoured with the essential oil of juniper. English *Gin* is the same kind of spirit, of an inferior quality, rectified with oil of turpentine.

Scotch and Irish *Whiskey* are modifications of the Dutch spirit, devoid of the juniper oil. The early communication of the Phœnicians with Ireland very probably introduced the knowledge of distillation into that country; Usquebagh was known and drank there long before Aqua Vitæ was even used as a medicinal cordial in England. The origin of the name Whiskey, which is a mere corruption of *Usque*, shows at once the source whence the Scots obtained their knowledge of ardent spirits. The Irish *Usquebagh*, as well as the English *Aqua Vitæ*, were compound spirits, and, according to the Red Book of Ossory, in which there are receipts for making them, they were compounded with saffron and some spices. They were supposed to operate in preserving health, dissipating humours, strengthening the heart, curing colic, dropsy,

palsy, quartan fever, stone, and prolonging life, and were therefore eagerly sought after: but, although this spirit was then emphatically termed Aqua Vitæ, its evil tendency in an over-dose was also known. One of its Irish appellations was *buileeann*, head-maddener; a name to which it has not forfeited its title by leaving out the saffron and the spices.

The best specimens of Scotch and Irish Whiskey are little more than pure diluted alcohol. They operate as simple Excitants, and, when properly diluted, are received into the circulation, and consequently augment the secretion of the kidneys.

*Rum** is prepared chiefly from fermented uncrystallizable sugar or molasses, and the scummings of the boilers used in the manufacture of sugar in the West Indies and Demerary. The chief peculiarity in this spirit is the large proportion of essential oil which it contains, derived from the raw juice of the sugar cane, and the fragments of the cane, which are mashed up and fermented with the other materials; for sugar, when employed alone, does not produce a spirit flavoured like Rum. This oil is extremely stimulant, and acts on the cutaneous capillaries, causing diaphoresis: it appears, also, to have a very powerful and deleterious effect on the nervous system, before age amalgamates it fully with the alcohol; for age renders Rum mild, and bestows upon it a softness and a rich flavour. The greater intoxicating property of new Rum cannot be accounted for by the alcohol which it contains.

Such are these four Spirits; all the others, whatever their denomination, may be regarded as merely modifications of these four.

Wine, the next combination of alcohol with other vegetable principles, is necessarily of much older origin than ardent spirits; as it must be produced before Spirits can be formed. The very first mention of Wine on record, shews us that the grape was the substance from which it was originally produced. We are told that, soon after the universal deluge, Noah began to be a husbandman, and planted a vineyard; and he drunk of the wine and was drunken. The descendants of Noah appear to have neglected no opportunity of improving the beverage of the antediluvian world, thus perpetuated by their great progenitor: indeed, it is very obvious that alcohol, in its combined state, is regarded by every description of mankind as one of the essentials of life; and the only inhabitants of the globe who have not manufactured an intoxicating liquor before Europeans appeared amongst them, are the New Zealanders, and the wretched natives of New South Wales and Van Dieman's Land.

* The name Rum is supposed to have been derived from the abbreviation of the Latin word *Saccharum;* but this is not very probable, as the liquor has always been known among the native Americans by the name of *Rum*. Nearly one gallon of Rum may be made from one gallon of molasses.

Before examining the general effects of alcohol and ardent spirits upon the living system, both in a dietetical and in a medicinal point of view, it is proper to make a few passing remarks on the manufacture of Wine, and on its chemical properties.

The VINE, Vitis *vinifera*, the type of the natural order *Vitaceæ**, was introduced into Europe from Persia, its supposed native country†; but it is also stated to be indigenous in Greece, and in Turkey in Asia, whence it was transferred to Italy. It was carried to France by a colony of Phœnicians, who founded the city of Marseilles; and into England, probably, by the Romans. It thrives only in those parts of Europe, the temperature of which is high in summer, although the winters be rigorous; but it is a plant easily naturalized. From some change in the climate of England, the Vine cannot now be advantageously cultivated here, although it is still attempted‡.

Like all plants that have been cultivated from time immemorial, the Vine varies greatly in the character of the fruit which it yields. The grapes in some instances are green or greenish-yellow§, in others red or purple‖. In some varieties they are an inch in diameter, in others scarcely the size of a pea. Although it is a climbing, slender plant, yet Strabo mentions a Vine, the trunk of which two men, with their arms outstretched, could not embrace. The extent to which it spreads is also occasionally astonishing: one branch of the Hampton Court vine is 120 feet long: the whole vine, some years ago (1829), covered a surface of 120 square yards; and in 1816 the crop weighed one ton. Pliny mentions a Vine which was 600 years old.

Although the British Pharmacopœias order only White Wine, yet it is used in all its forms, as well medicinally as dietetically.

WINE, *Vinum Xericum*, L. *Vinum album*, E. *Vinum album Hispanum*, D. is the juice of the fruit of this plant, pressed and fermented: and although every saccharine vegetable product, if fermented, will yield wine, yet none equals that of the grape. The

* Woodville's Med. Bot. third edit. p. 144, pl. 57. London Dispensatory, art. Vitis. Richard, Hist. Nat. Med. t. ii, p. 704. Lindley, 65.

† At Shiraz, Sir R. Kerr Porter (Travels in Georgia and Persia, vol. i, p. 706) describes the grapes as growing to a size hardly to be matched in other climates: but these, Mr. Morrier (Journey through Persia) says, are surpassed by those of Casvin. Indeed, they every where abound in Persia, and their quality is excellent. At Damascus, bunches of grapes often weigh from twenty to thirty pounds. The countries where the Vine is most generally found indigenous, lie between the 26th and 44th degrees of north latitude, and the 26th and 75th of east longitude.

‡ Independent of wine, nearly 8000 tons of resins, yielding to the revenue £160,000, and undried grapes in sufficient quantity to give a revenue of upwards of £10,000, are annually imported into England.

§ White Frontignan, Royal Muscadine, Chasselas Musquè, White Muscat of Alexandria, Sweet Water, &c. &c.

‖ Black Frontignau, Black Hamburgh, Black Murocco, Black Burgundy Cluster, &c. &c.

quality of wine differs greatly. The kind of grape, the nature of the soil, the exposure, elevation, and degree of latitude, exercise a decided influence upon the chemical character of the juice of the grape, and consequently on the wine which it forms; the quality and flavour being as various as the countries, the exposure, and soil, in which the Vine is cultivated. That wine which contains the largest quantity of aroma and of intimately combined alcohol, is regarded as the most generous; but the wines of France and those of the Rhine possess agreeable properties, which cause them to be preferred for the use of the table to those of a stronger quality. The grapes ripened in warm climates, as they are more impregnated with saccharine matter and possess more aroma than those of cold climates, if properly managed, always yield the best wine.

The expressed juice of the ripe grape contains a large quantity of very soluble *uncrystallizable sugar*, *extractive*, a small quantity of *mucilage* or *gum*, *glutinous matter*, *malic acid*, *citric acid*, *bitartrate* of *potassa*, and *lime*. After the expressed juice, or *must* as it is termed, has remained at rest for some time, at a temperature of 65° Fahr. the whole becomes moderately warm*, and undergoes decomposition; much carbonic acid gas, in small bubbles, is evolved; an intestine motion is raised, and the soft parts are thrown upwards, forming a thick scum which collects on the surface, and is emphatically called the *hat*. This intestine action is accompanied by a hissing noise, and a farther increase of temperature; the mixture, which was before sweet, soon loses its saccharine properties, in a great degree, and acquires a vinous taste, a deeper colour than before, and an odour of alcohol; the intestine motion then gradually diminishes, and soon, apparently, ceases altogether; the liquor becomes clear, and, being now wine, it is put into casks. The marc, or insoluble part, is next submitted to pressure; and, as the wine obtained from it has been very imperfectly fermented, when it is added to that in the barrel or the tun, the fermentation is renewed, and is continued for many months in a state of less activity than before; throwing up slowly a scum similar to that already mentioned.. This scum at length sinks to the bottom of the vessel, carrying with it a certain quantity of the colouring matter, some bitartrate of potassa and of lime, forming a crust called *Argol;* and the wine is fit for use. Such is the progress of the fermentation by which wine is produced; but there are other parts of the process, such as *racking* off into other casks, *sulphuring* and *refining*, which it is unnecessary to detail†. How can the changes be explained on chemical principles?

Besides the principal constituents already noticed, the juice

* The temperature sometimes rises to 99° Fahr. The state of the atmosphere influences this greatly: in cold weather the process languishes.

† See Chaptal, *D' Art de faire le Vin*, 1819. Macculloch on making Wine, 1816.

of the grape also contains an azotized vegetable extractive, which, according to Thenard and some other chemists, acts as a leaven, and is the component which sets on foot the fermentative process. This substance attracts a portion of oxygen from the sugar of the must, and, combining with it, is insoluble and precipitates in the form of lees. The affinities of the constituents of the sugar being thus broken, they enter into new combinations; a portion of the oxygen and carbon unite to form carbonic acid, which flies off in a gaseous state; whilst the remainder uniting with the hydrogen and the rest of the carbon, alcohol is produced. (See p. 110). The general constituents of wine are *alcohol, volatile oil, colouring matter, tannic acid, bitter extractive, gum, ferment, acetic, malic, tartaric* and *racemic acids, bitartrate* of *potassa, bitartrate, sulphate, and phosphate of lime, chloride* of *calcium, carbonic acid*, and *water**.

Wines differ in colour; the red are coloured by the skins of the grapes employed: for the wine is not coloured if the skins of the grape be not fermented in the must. Wines thus manufactured are not sparkling. To procure sparkling wines, the wine is bottled before the fermentation is completed: but, as this proceeds in the bottle, the carbonic acid, being prevented from flying off, is redissolved in the wine, and ready to be extricated the moment the cork is drawn. In some instances, as for example in Champagne, the wine not being naturally sweet enough, some sugar-candy is added.

All wines contain the principles both of improvement and of decay. When new, they are not wholesome; and it is only after the secondary fermentation has been carried on for some time, under due attention, that the wine becomes mellowed and fit for use. Much, however, must depend on the original quality of the vintage.

Wine is frequently adulterated. When the adulterations are colouring matters or admixture with inferior wine, they are at least innocent: but this is not always the case; for when wine turns sour, it is sweetened with oxide of lead†. This is detected by various reagents:

Water impregnated with *Sulphuretted Hydrogen gas* throws down a black precipitate.

Chromate of Potassa, a yellow precipitate.

Gallic Acid, yellowish-white precipitates.

Iodide of Potassium, added in solution to the residue of the evaporation of the wine, treated with dilute nitric acid, gives a lemon-yellow precipitate.

The Oxide of Lead, however, may be formed by cleaning the bottles with shot, and thus enter the wine. But there may be salts of Copper as well as of Lead in wine; which is, however,

* Gmelin.

† This practice of using litharge to sweeten sour wines appears to have first attracted attention in 1696, when mention is made of it in an ordinance of the French police.

easily detected by a brown precipitate being obtained with solution of ferrocyanate of potassa.

Arsenious acid is sometimes used instead of the oxide of lead, to doctor sour wine. It is detected by saturating a portion of the suspected wine with nitrate of silver in excess, which throws down any muriate or sulphate the wine may contain; and then, when the solution has become perfectly clear, touching the surface with a glass rod dipped in ammonia: a yellow precipitate, arsenite of silver, will immediately fall from the point of the rod. To demonstrate that this precipitate arises from arsenious acid, we have only to add ammonia in excess; when, if it be arsenious acid, the precipitate will be dissolved. Or the wine may be tested with the improved Marsh's apparatus.—(See Appendix.)

In examining the effects of Alcohol as an Excitant on the animal œconomy, I will adopt the same arrangement as in the investigation of its physical and chemical properties; first taking into consideration its general effects in its *uncombined* or pure state, and, afterwards, those which it exerts in a state of *combination.*

* *Uncombined Alcohol.*

If Alcohol in its pure state be applied to dead animal matter, it acts as an astringent, lessening the bulk of the substance and condensing it; but this effect is due, in a great degree, to its powerful attraction for water, and the augmented density which results from the abstraction of the water. Owing to this power of increasing the cohesiveness of dead animal matter, the substance upon which Alcohol has acted is, undoubtedly, less liable to undergo the decomposition which all dead organized matter rapidly suffers; and on this account strong Alcohol is said to exert an antiseptic power. The same property of attracting water bestows on Alcohol the property of coagulating albumen in animal matter; and, in proportion to the insolubility of animal substances, they become more permanently capable of resisting the impression of other agents. The consideration of this influence of Alcohol, on dead animal matter, induced some to believe that it acts nearly in the same manner on the living body: but this is not the case; for, while vitality continues, no power with which I am acquainted can coagulate the fluids. This opinion seems to be at variance with experiments made by Orfila and other physiologists. He injected four drachms of Alcohol into the jugular vein of a dog, the blood became coagulated and he instantly died*. But in this case we have no evidence to show that the coagulation happened before the death of the animal.

Toxicologie Generale.

Uncombined or concentrated alcohol operates as a most powerful excitant to the living body, whether of man or the lowest Zoophyte, producing condensation of tissue, pain, heat, and inflammation; effects partly depending on its chemical affinity for water, partly on its physiological influence over the organism of the body.

The exciting property of concentrated Alcohol becomes obvious to our senses, by the effect which it produces on the organs of taste and of smelling. When taken into the stomach in large doses, its primary action is local on the organ itself; it excites a burning sensation; violent pain; inflames the mucous membrane, and almost instantly destroys its vitality: the shock is communicated through the nerves to the brain; and the individual often dies before there is time for absorption to have taken place. The truth of this remark has been demonstrated by the experiments of Mr. Brodie. When he killed animals by injecting Alcohol into the stomach, he always found, on dissection, that the organ displayed marks of severe inflammatory action, and that blood was extravasated between the coats; but, except a gorged state of the vessels, no preternatural appearances were remarked in the brain; the inference, therefore, that the fatal shock is altogether on the nervous energy, is strengthened by dissection. Its chemical influence follows, and the blood is coagulated, when the pure Alcohol is thrown into the vessels of the animal. But this state is only the result of the admission of Alcohol, in its highest state of concentration, into an organ of extreme susceptibility, although of little sensibility: when it is partially diluted, it acts with less energy, is taken into the circulation, and merely produces that state which is termed intoxication.

When moderately diluted uncombined Alcohol is applied to the living body, the first effect is that of a powerful excitant: it acts upon the nervous system, increasing the energy of the vascular, diminishing the capacity of the blood-vessels, and adding to their power of carrying forward the blood which they contain. This effect is in the direct ratio of the strength of the Alcohol, and the susceptibility of the part to which it is applied; thence, in parts of the body in a state of inflammation, Alcohol, applied as a local excitant, relieves the state of congestion, or over-distension of the vessels which characterizes that morbid condition. When it is applied, however, to healthy surfaces, particularly to those in which there is much sensibility, the impression of increased energy, and the contraction which suddenly takes place and renders the portion of the surface acted upon pale, is of short continuance; the vital energy is rapidly exhausted, and inflammation is the consequence. This is not the proper place to enter into an enquiry regarding the theory of inflammation; but it is impossible to see these effects of the application of concentrated Alcohol to inflamed and to healthy

surfaces, without forming in the mind some explanation of the phenomena passing before us.

On the habit generally, the influence of moderately diluted uncombined alcohol is nearly the same as in its concentrated state; but if it be not sufficient to destroy life, that condition of the brain and nervous system which produces intoxication rapidly follows.

It is not easy to explain, very satisfactorily, the condition of the brain under these circumstances; whether it can be regarded as one of activity: or, as in some kinds of delirium, a state of inertia, in which the mind acts as it were independent of the material organ with which it is connected, and ideas succeed one another in certain associations.

In examining the effects which follow the introduction of a large quantity of moderately diluted alcohol into the stomach, we find that the *first* is the local excitement of the viscus, indicated by a sensation of heat in it, an effect the result chiefly of the impression of the alcohol on the gastric nerves, increasing the sensibility of the organ: this impression is next conveyed to the brain, spinal marrow, and entire nervous system; ideas of unusual brilliancy pass through the mind; there is, as it has been beautifully expressed, a soft tumult of the soul; Fancy is awakened, and creates, from uninterrupted associations, new combinations and a world of its own: and it is at this moment, between sobriety and intoxication, that the poet sometimes pours forth his sublimest conceptions and most harmonious strains. As the power of the stimulus however increases, the *second* set of symptoms, depending on the continued excitement, commences. All control of the will is suspended; the ideas are then irregular; and, instead of being combined in such a manner as to produce even agreeable conceptions, they arise in the most incongruous order; the extent of the excitement of the cerebro-spinal centres becomes apparent in the unusual vivacity of the eye. There is often nausea and vomiting, accompanied with swelling of the veins of the neck, and beating of the carotids. Symptoms, indicating cephalic congestion, quickly follow; namely, pain in the frontal region; the head drops upon the chest; the eyes lose their expression, and are half closed; the physiognomy is altered and vacant; the voluntary muscles cease to act; the arms are pendent, or their movements are irregular; the legs cross one another in the effort to walk; vertigo supervenes, and delirium follows. The exhausting influence of such a state is too great to continue, and the *third* stage displays its effects. In a short time, collapse, and sleep resembling that of apoplexy, follow. Under certain states of the habit, that condition actually occurs, and the sleep of the drunkard may prove the prelude to death; but, in the majority of instances, Nature adopts this method of restoring the exhausted excitability. The

individual, however, does not awake in his usual state; his hand is tremulous; his limbs are weak and unsteady; his surface is susceptible of the slightest impressions; his stomach nauseates all kinds of food; his thoughts are gloomy; his temper irrascible; and, if the moral principle be not blunted by the frequent repetition of this vice, his mind is overpowered with the most distressing sense of degradation. By degrees, however, the system recovers its usual condition.

The tumult, which the administration of a large quantity of even diluted alcohol on the living system causes, is thus rendered very obvious; and, as I shall afterwards prove, depends chiefly on the impression of the Excitant on the nervous system, although not wholly independent of absorption. The truth of this position is maintained, not only by the fact that intoxication is produced more rapidly and by a much smaller quantity of spirits, when it is taken into the stomach in such a manner that the nerves of the mouth and those of the tongue and fauces shall be topically acted upon, but by the fact that a person who is intoxicated becomes often suddenly sober after vomiting.

The Burmese and Siamese become inebriated by sucking Soura through a reed; and even two or three glasses of wine will cause intoxication, if the fluid be sipped and allowed to pass slowly over the tongue. That this is the effect of alcohol on the extremities of the nerves, is well illustrated by the following anecdote. A merchant, who had collected furs on the Mississippi, when Louisiana was yet almost in a state of nature, carried the cargo to Jamaica to sort the furs before transporting them to Europe. He hired a store in Kingston, in the yard of which were several casks placed on end in the sun, and employed as labourers, to assist in landing his furs, several soldiers of the garrison, men who had been in the habit of drinking freely of new rum, and who were able to sustain, with impunity, very copious libations of ardent spirits; nevertheless these men were drunk every day before noon. On investigating the cause, the merchant discovered that they had broached one of the casks, all of which contained Madeira wine, and that they became intoxicated by sucking the wine through straws.

When a fit of severe intoxication is induced, it is not easy to anticipate the result. Mr. Bedingfield, however, has directed attention to one symptom which is likely to aid our prognosis. "If the iris," says he, "retain its contractile power, the patient will generally recover, however overpowered the senses may be; if, on the contrary, it remain in a state of extreme dilatation when a strong light is directed upon it, only a feeble hope of recovery can be entertained*." The first object, in a case of intoxication, as in every case of poisoning, is to dislodge the offending matter as quickly as possible; and the stomach-pump

* Bedingfield on Medical Practice.

should be employed in these cases, as in other instances of poisoning. Emetics seldom operate during intoxication, although vomiting is one of the accompaniments of that state. Our second object is to obviate the impression made on the nervous system; and, to effect this, nothing answers better than the solution of acetate of ammonia, in doses of f℥ii to f℥iv, in a glassful of water, repeated once in ten or fifteen minutes. This seems to exert almost a specific effect upon the habit, and prevents those uncomfortable feelings which invariably accompany the transition from drunkenness to sobriety. The post-mortem examination of the bodies of those who have died in a state of intoxication has not always detected traces of topical inflammation of the stomach, unless the individual had been a confirmed drunkard; in which case, not only have its vessels been found injected, but the whole coats thickened and approaching to a carcinomatous state in the pyloric portion. The cerebral vessels are always found congested; the substance of the brain contains alcohol*, and it is said to have been found in the cavities; but this is not consonant with my experience†. It has also been detected in the blood, the bile, and the urine‡.

The stomach and nervous system may resist the deleterious influence of occasional intoxication; but a regular train of intemperance never fails to produce its baneful influence, both on the body and the mind. By degrees the mucous membrane of the stomach, and even the other coats of that viscus, suffering under repeated attacks of inflammation, undergo changes of structure, and indurations supervene, which occasionally degenerate into cancer of the pylorus; or, inflammation of the liver, palsy, dropsy, epilepsy, and many other bodily ailments, overpower the vital energy of the habit. The disease of the liver, arising from the abuse of ardent spirits, is characterized by the tawny, yellow hue of that organ; thence the term *cirrhosis* given to it by Lænnec. The vessels of the portal system are compressed by a preternatural contraction of the fibrous, the result of which is impeded circulation and ascites. A similar morbid condition is also frequently induced in the kidney, which becomes granular, and secretes albuminous urine. Both diseases generally terminate fatally.

Amongst the diseases, resulting from a course of intemperance in the use of ardent spirits, is *delirium tremens;* a disease involving the whole of the nervous system, accompanied with general debility, restlessness, inappetency, confusion of ideas, wildness of look, tremors of the extremities, sometimes extending to the trunk, vertigo, and delirium. These symptoms can be invariably referred to habitual intoxication, when the accustomed excitant is suddenly substracted; and even in some

* Dr. Percy's Prize Essay, 1839, pp. 102, 112.
† Cooke on Nervous Diseases, vol. i, p. 222. ‡ Dr. Percy, Prize Essay.

instances when it is not withheld. It is a disease of debility; for as the excitement which alcohol impresses on the stomach is communicated to the nervous centres, the renewed irritations of the brain exhaust its powers; and the organ of intellect being no longer in a healthy state, the mind itself suffers, and delirium supervenes. But it must be confessed that the pathology of the disease is obscure. Dr. Schultz, of Berlin, has lately referred it to a change effected in the corpuscules of the blood*. If such a state of brain does not supervene the intemperate use of ardent spirits, the nervous system does not escape with impunity; the memory and the judgment become enfeebled; and, as during every debauch there is a temporary aberration of intellect, the frequency of these, when a disposition to insanity exists, at length shakes Reason from her seat for ever. It may be said that some men have lived to a good old age who have been habitual drunkards: this is true; but it is the exception to a rule†.

With respect to the influence of alcohol on the nervous system in producing these effects, there can be no doubt. The first impression made upon the nerves of the stomach is communicated to the cerebro-spinal centres, and simultaneously from them to the whole system: but this sympathetic action is soon augmented by the absorption of the alcohol and its immediate application to the central organs themselves. According to the experiments of M. Ségalas, diluted alcohol injected into the veins or the bronchial tubes, or applied upon serous membranes, produces intoxication as rapidly as when it is taken into the stomach; and this effect is retarded or accelerated by circumstances that retard or quicken absorption‡. Even the muscular tissue becomes impregnated with alcohol in habitual drunkards: and if the relations of spontaneous combustion which have been published are authentic, they are probably owing to the manner in which this fluid pervades every texture of the body§. Those individuals who have thus perished, emit at every point a strong odour of alcohol; and all of them have indulged in the immoderate use of ardent spirits: the vital powers of the system have been thus greatly lowered, which, in conjunction with the natural

* Hufeland's Journal, April 1841.

† This resisting power of some constitutions is well illustrated by the Poet of the Seasons:

> "Perhaps some doctor of tremendous paunch,
> Awful and deep, a black abyss of drink,
> Outlives them all; and from his buried flock
> Retiring, full of rumination sad,
> Laments the weakness of this latter time."

‡ Revue Med. tome ix, p. 476.

§ Breschet, on opening the bodies of criminals shortly after their execution, observed that, in those addicted to drinking spirits, a strong odour of eau de vie exhaled from every part: and Dr. Marc has recorded the case of a shepherd, addicted to the same vice, who, during his last illness, eructed inflammable gas which smelt strongly of alcohol. Dr. Percy found alcohol in the tissue of the liver, in that of the brain, in the blood, the bile, and the urine.

debility of age, for they have all been advanced in years, may produce some pathological state which favours the phenomenon, although we are ignorant of its nature.

If the abuse of alcohol produce such melancholy results, the medicinal employment, and the moderate use of it, under certain circumstances, are of great benefit to the human race. Temperately taken, largely diluted alcohol operates as a wholesome stimulant; rousing the action of the heart and arteries, diffusing an agreeable increase of temperature over the body, assisting the powers of the stomach, promoting the various secretions, and exalting the nervous energy. It may be reasonably asked, however, of what benefit is even the temperate use of ardent spirits to a healthful individual, who requires no additional excitement either of his mental or his corporeal energies? To this question no satisfactory reply can be offered: and, notwithstanding the universal propensity of the human species for intoxication, and the ingenuity exercised in obtaining means to effect it, yet Ardent Spirit can be justly regarded in no other point of view than as either a medicine or a poison.

As a medicinal agent, alcohol is a most powerful and universal Excitant. It is rarely necessary to administer undiluted spirits, except in cases of retrocedent gout and similar affections. Like every other powerful Excitant, Ardent Spirits rapidly exhaust the nervous energy; but although on this account their action is followed by sedative and narcotic effects, yet their exciting influence is too great to permit us to employ them as a narcotic. It is of great importance, however, to give them undiluted in cases of poisoning by sedative poisons.

Diluted Alcohol, ardent spirits, can be used only in those fevers, and in those periods of fever, which indicate much depression of the powers of life: even in the lowest fevers, the dilution must be very considerable: one part of ardent spirits to four or five parts of water, sweetened with sugar and acidulated with lemon-juice, form an excellent substitute for wine; nevertheless, it is more heating and less tonic than the fermented juice of the grape.

Alcohol, however, although so powerfully exciting, yet, when properly diluted, may be employed, under certain circumstances, in the phlegmasiæ, if no vital organ be affected. In passive hæmorrhages, the use of diluted alcohol has been sometimes advised: if it can prove in any way useful in these cases, we must look for the cause of the benefit in the exciting property of the alcohol, which enables it to apply those curative powers that, without adopting the wild doctrines of a "*vis medicatrix naturæ,*" tend to restore every diseased state of the functions to the natural condition, or that of health.

In all chronic diseases, which are generally those of debility, alcohol, properly diluted, may be administered. It is very commonly employed, in dyspepsia, for removing the supposed debility

of the stomach; and for this purpose it is given, in conjunction with bitters, aromatics, and tonics in the form of tinctures: but much caution and great judgment are required for prescribing it in these cases. In dyspepsia, too, little attention is given to ascertain the real state of the stomach and other digestive organs: debility is often inferred when the symptoms proceed from subacute inflammation; in which condition of the organ, there can be one opinion only with respect to the impropriety of prescribing Excitants under any form. When dyspepsia is accompanied with vomitings, colic, or hiccough, depending on some morbid action of the brain and the spinal marrow, then the powerfully inciting influence of spirits on the stomach may prove beneficial, by inducing, as it were, a revulsion, and breaking, in a short time, the morbid train of diseased action present in the stomach, the intestines, or the diaphragm. A singular therapeutical effect of the internal use of diluted alcohol may be here noticed. The natives of the Friendly Islands, when Captain Cook first visited them, manufactured an intoxicating beverage from the root of the Kava plant, which they chewed and mixed with water. Although it is extremely intoxicating, and so destructive to health, that on the second visit of Captain Cook, he saw many of the natives reduced to mere living skeletons from its use, yet we are told that it is a remedy for syphilis; a disease which the intercourse with Europeans has entailed on these Islanders. When first taken as a remedy, a scaly eruption breaks out over the skin; by degrees the scales fall off in the order of their formation, leaving the cuticle smooth and clear, and the system free from disease: at least, such is the account given by a gentleman who visited these islands some years since*.

As an external application, diluted alcohol is an admirable Excitant; gently constringing the vessels and communicating a new stimulus to inflamed surfaces. Thus it forms an excellent lotion, when moderately diluted, in erysipelas, in erythema, in burns and in scalds while the cuticle is yet entire, and in sprains and recent bruises. In these cases, it allays pain, affords by its evaporation a sensation of cooling to the inflamed surface, and stimulates gently the overloaded vessels to carry forward the blood with which they are oppressed. On the same principle, warm spirit of wine is beneficially applied in burns and scalds; it prevents vesication, and constringes the relaxed and overloaded vessels; and, for the same reason, it is equally beneficial in passive hæmorrhage; whilst it also aids, by its mechanical property of coagulating the blood, the formation of a clot—the mode which nature adopts in all cases of ruptured vessels.

In pharmaceutical operations, Alcohol, both concentrated and diluted, is most extensively employed. The former (sp. gr. .815) is, however, never required; but, in its form of rectified

* Literary Gazette, 1821.

spirits (sp. gr. .838), it is essential in the formation of *Ethers*, *Oleum Æthereum*, many of the *Tinctures*, some of the *resinous extracts*, and for the separation of *Aconitia*, *Strychnia*, and *Veratria* from the vegetable bodies containing them; whilst that of sp. gr. .920, namely, proof spirit, is still more requisite for carrying on the operations of the laboratory*.

* * *Combined Alcohol.*

Alcohol is present in Wine and all fermented liquors, as the result of the processes by which they are obtained. Having explained the theory of the formation of these productions, it now only remains to notice their physiological influence on the animal œconomy, and their uses, dietetical and therapeutical.

Wine not being a simple substance, but containing, as already stated, *alcohol*, *bitter extractive*, *sugar*, an *odorous principle*, *tannic* and several *acids*, *bitartrate of potassa*, and colouring matter, it cannot, when taken into the stomach, be regarded in the same point of view as merely alcohol diluted with a large proportion of water; something must therefore be referred to the chemical properties, as well as to the physiological influence, of the substances with which it is combined. If the wine contain much acid, and particularly if this be malic acid, the tendency to decomposition, in the human stomach, and to increase the acescency in the other contents of the viscus, when the vital action is languid, are well known; and consequently we might conclude that wine, in a dietetical point of view, instead of promoting, tends to disturb the powers of digestion in the dyspeptic. It is a curious fact, also, that these disadvantages are augmented when the wine contains uncombined brandy. Some explanation of this may be obtained from the fact, that the addition of a certain portion of free alcohol, instead of checking fermentation, favours it. When the alcohol is intimately combined with the other ingredients of the wine, and the acid is the tartaric, at least when the malic and acetic acids do not abound, then, instead of interrupting digestion, the temperate use of wine tends to promote it, by stimulating moderately the nerves and the muscular coat of the stomach, thus favouring the proper secretion of the gastric juice, as far as regards both its quantity and quality. This wholesome stimulus will, nevertheless, vary in proportion to the nature of the aromatic principles contained in the wine, even when the

* Tinctures, as the term is now generally understood, are spirituous solutions of such of the proximate principles, chiefly of vegetable substances, as are soluble in pure or in diluted alcohol. Few tinctures are prepared from animal matters, and the principles taken up are analogous, with a few exceptions, to those belonging to the vegetable kingdom; namely, *extractive*, *sugar*, *gum-resins*, *resins*, *volatile oils*, *camphor*, *guaiacum*, *iodine*, *tannic* and several other *acids*; the resinoids, *piperina*, *salicina*, and *scillicina*; and the alkaloids, *quina*, *cinchonia*, *veratria*, *colchicia*, *strychnia*, *aconitina*, *elateria*, *morphia*, *codica*, *narcotina*, &c. Numerous improvements have taken place in the formation of tinctures; but it would be out of place to comment upon them in this work.

alcohol is, as it were, disarmed of any deleterious properties by its intimate combination. The nature of this combination, into which alcohol enters, influences also the effect of wine in causing intoxication; for, if we take the same quantity of brandy or alcohol contained in a given quantity of wine, and merely mix it with water, it will sooner and more effectually produce intoxication than when it is taken in the shape of wine. This, however, does not arise from the mere presence of other ingredients; for alcohol, mixed with these in the same proportions as they are found in wine, is equally deleterious and inebriating. It is, therefore, evident that the dietetical properties of wine depend greatly on its nature and quality; and it is as evident that the manner in which the alcohol is combined with its other ingredients greatly modifies the influence of that agent on the system; or if the alcohol be added to the wine after it is made, as is too often done, then wine is as intoxicating as simple diluted alcohol.

Something is due, in reference to the effects of wine, to the time at which it is usually drunk. Custom has consecrated to this purpose the time immediately after our principal meal, dinner, in this country; but, if we reflect that the stomach is then loaded with food, that the process of chymification is a natural one, and is likely to be rendered imperfect, either by any thing which can interrupt the series of changes which it is intended to produce, or by altering the affinities of the components, or by overstimulating and consequently hurrying the secretion of the gastric fluid, we can scarcely imagine a worse-selected time for drinking wine than after dinner or after supper. It is true that this custom has been followed from time immemorial; and neither the moralist nor the physician is likely to have influence sufficient to alter it: but if the physician cannot interfere with the habits of the healthy, he can at least warn the invalid of his danger, and point out to him the proper time of taking wine, when this is necessary for promoting the powers of digestion*. Now, if our object be to excite the stomach, so as to enable it to secrete a better description of gastric juice, it is certainly more rational to effect this before the stomach is called

* Although excessive drinking is more prevalent among barbarous than civilized nations, yet the most refined, both of ancient and modern times, have not been free from this vice. This was the case in Greece and Rome; and, towards the decline of the Roman Commonwealth, even the ladies drank to excess. The quantity taken by the men was quite incredible: Novellus Torquatus received from Tiberius the title of *Tricongius*, because he could quaff three gallons of wine at a draught; and it is stated that the emperor Maximin could drink six gallons of wine without feeling its effects. Strabo informs us that the Lusitanians sometimes exhausted a whole vintage at one feast; and Charles the Great published an edict obliging the judges on the bench and the pleaders at the bar to remain sober: indeed, the feasts of the Gauls ended generally in conflicts, and frequently in bloodshed. With regard to our own country, when we observe the daily abuse of spirits by the lower classes in the present day, it is melancholy to compare this statement with the following account of our countrymen in the beginning of the seventeenth century:—" In general, the greater and better part of the English hold all excess blameworthy, and drunkennesse a reproachfull sin."—Fynes Moryson's Itinerary, part iii, p. 152.

on for the performance of its digestive functions, than at the moment when it is in the actual execution of the function for which the improved secretion is intended. The experiments, also, of Dr. Schwann* have demonstrated that the alcohol renders the digestive principle inert. In a dietetical point of view, therefore, wine should be taken before dinner, or at some period of the day when chymification is not in its progress. A question, however, here presents itself—is it at all requisite in a healthy condition? I reply—no: and, even when it is demanded, the number of cases of dyspepsia depending on mere want of tone in the stomach are few; and it is in such cases only that wine or alcohol, in any form, can be properly prescribed. In dyspepsia, in general, there is a morbid determination of blood to the mucous coat of the stomach and the intestinal canal: this is marked by heartburn, irregularity of appetite, nausea, depression of spirits, dreaming, weight and pain in the head, vertigo, and uneasiness, if not pain, in the stomach itself. At such a time, the effect of the administration of wine is likely to be subacute inflammation of the stomach and intestines; if gout, erysipelas, anasarca, or some other disease, do not supervene as a salutary process to relieve the digestive organs: but custom is too powerful an opponent of the doctor; and, therefore, the physician can only direct the choice of that wine which is least likely to interfere with the healthy functions of the system. There are four distinct descriptions of wines dietetically employed in this country: *sweet; brisk* and *sparkling; light* and *subacid* wines; and *dry strong* wines.

The *sweet* wines in occasional use in England are *Mountain, Malmsey-Madeira, Constantia, Tent, Lisbon, Frontignac,* and *Tokay;* but to these, as occasionally used, we may add, *Lachryma Christi, Shiraz,* and the *Grape and Raisin wines* of English manufacture. All these wines are exceedingly apt to disorder the stomach, owing to their imperfect fermentation. Sweet wines do not intoxicate so freely as some other wines; and, as the ancients used them in preference to the other wines†, and diluted them with hot water, it is probable that their powers of drinking large quantities of wine with impunity depended, in a great degree, on this choice of their wine. They were also those chiefly used in England before the middle of the seventeenth century‡. When new, the sweet wines are most apt to derange the digestive function; in their more perfect state, they may serve as agreeable and useful cordials; but, as in every condition they promote acidity, they should be drunk only in very limited quantity.

* Muller's Archiv. 1836, p. 90.

† In the Grecian feasts, a portion of sweet wine was presented to the guests in the middle of the repast by a female attendant, generally selected for her beauty, who bore it in a rich silver vessel of a peculiar fashion, from which each guest drunk in his turn.

‡ In a statute of the first Parliament after the Restoration, granting a tonnage to the King on all wine brought to England, is the following list—"Muscadels, Malmseys, Cuts, Tents, Allicants, Bastards, Sacks, Canaries, Malligoes, Maderaes."

The *brisk* and *sparkling* wines are the produce of Champagne chiefly; but, of late years, a brisk wine has also been manufactured on the Moselle, and in Burgundy. These wines seem to affect the nervous system very rapidly, and intoxicate sooner than dry wines which contain a much larger proportion of alcohol. Port wine contains f℥ii of alcohol in f℥viiiss of wine; yet it does not intoxicate so rapidly as Champagne, which contains the same quantity in thirty-two fluid ounces of the wine. This may depend on the alcohol combining intimately with the carbonic acid which Champagne and other sparkling wines contain, and rising with this gas. The alcohol of the wine is thus more directly applied to the extremities of the nerves of the stomach, in a form peculiarly well calculated to make a powerful impression upon them. But, if these wines intoxicate more rapidly than other wines, their effect is more transitory; they pass off rapidly by the kidneys, the recovery from inebriation from their use is quicker, and the subsequent exhaustion less, than from other wines; thence a fair inference may be drawn, that, in this respect, they are undoubtedly more wholesome. In some hypochondriacal diseases, and what are termed nervous affections, they may be drunk in moderation; and few opinions are more fallacious than that which regards them as injurious to gouty habits. It is the variety and the richness of the viands which the gouty man partakes of, when he indulges in Champagne, not the wine, which favours the return of his malady. Something, however, must be attributed to the nature of the wines, in deciding on their wholesomeness. When they effervesce greatly, it is a proof that they are either too new, or that they contain substances, such as sugar-candy and cream of Tartar, introduced expressly to promote their briskness. Indeed, the still wines of Champagne, or those that effervesce only moderately, are always to be preferred*.

The *light* wines of the Rhine, and those of the Bordelais or Gascony, are certainly much less likely to influence, injuriously, the nervous system than any others. They are less intoxicating, and generally possess diuretic properties. Those of the Rhine also, when good, are not acidulous to the taste, as is generally supposed, and are less likely to ferment on the stomach than stronger wines; both because the acid which they contain is the tartaric, and also because their alcohol is more intimately combined with the other principles of the wine. They are drier and more aromatic than the French wines; they do not contain half

* The best of the white wines of Champagne—namely, Sillery—is a dry, still liquor, and of considerable body or strength: but, notwithstanding this property, it is less likely to injure the stomach than the lighter sparkling wines. The Wine of Ay, which sparkles to a certain degree, but only to the extent of creaming on the surface, is also less hurtful than those that rapidly part with their carbonic acid: namely, those grown on the river Marne, which are most commonly drunk in England.

the quantity of alcohol usually found in the Sherry and Madeira imported into this country: they hold no undecomposed saccharine matter; and, as already stated, the acid which they contain is the free Tartaric. The same causes, therefore, which give durability to the Rhine wines, render them more wholesome, and less apt to sour or aid the acescence of other substances in the stomach, than stronger wines*. Those of the Bordelais, or Clarets†, possess less aroma and spirit than even the Rhine wines. They are undoubtedly the most perfect which France produces: the quantity of alcohol contained in them is small (f℥iv in f℥xxvi); but it is so intimately combined, that these wines are not less wholesome than Rhine wines: but either kind is certainly the safest for daily use. The anathema often pronounced against them as productive of gout is unjust: sound Hock and good Claret may be drunk with more impunity by the gouty patient than Madeira or Sherry.

The *strong* wines, such as *Port*, *Sherry*, *Madeira*, and the spirituous and highly aromatic wines of Burgundy, are the least wholesome, although they are those most generally drunk in Great Britain. Much of the potency of Port and Sherry‡ arises from uncombined brandy, which is mixed with them previously to their exportation§. The large quantity of tannic and gallic acid, also, which they contain renders them hurtful as a daily beverage: they intoxicate much sooner than the light wines; and, from the nature and quantity of their volatile oil, they affect the brain in the same manner as narcotics; not exhilarating and enlivening the fancy, except in the very outset of their influence, but producing a sluggish state of the system, and an evident tendency to apoplexy. The light wines of Burgundy and some of the wines of Spain and Portugal are free from these injurious properties; but they are, nevertheless, more pernicious in their effects than the wines of France and the Rhine.

These observations apply equally to ale, porter, cider, and mead. In the ale and porter, the saccharine matter furnishes vigour to the system, whilst the bitter of the hops aids its diges-

* The best of the Rhine wines is the Johannisberger, grown on the estate of Prince Metternich, near Mayence; next to that, the Steinberg; and, in succession, Rüdesheimer, Grafenberg, Markebrunner, Hochheimer, Liebfrauenmilch, and Scharlachberger; and this order we may also pronounce to be that of their wholesomeness.—See Henderson's History of Ancient and Modern Wines, pp. 220-225.

† Those known under the names Lafitte, Latour, Chateau Margaux, and Haut Brien, are the most esteemed. Henderson says "The aroma of the first growths is seldom fully developed till after they have been kept eight or nine years."—L. c. p. 185.

‡ Sack, immortalized by Shakspeare, was a sweet variety of Sherry, and was formerly the favourite wine in England.

"—— Sack says my bush;
Be merry and drink Sherry; that's my posie."—*New Inn*, *Act* 2.

§ In Mr. Brande's table we find the following to be the proportion of alcohol (sp. gr. 0.825), by measure, contained in 100 parts of these wines:

Port, 22.96. Sherry, 19.17. Madeira, 22.27.

tion: but the daily use of malt liquors disposes to plethora, causes dyspepsia, and produces a tendency to apoplexy. Cider and mead act on the stomach like the lighter wines.

With regard to the therapeutical use of wine, man seems very early to have viewed it as a medicinal cordial: thence we find some references to its employment in disease in the history of almost every people. The Pramnian wine of the Greeks was a medicinal wine; on which account it was sometimes named *Pharmacites**. The Chian wine was also prescribed as a reviving cordial by the physician. Among the Roman wines, that of *Cæcuban* was noted for its restorative virtues†. The *Surrentine* and the *Massic* were also medically recommended. The *Faustian* was of so spirituous a nature that it would burn with a pure and bright flame. The *Falernian,* so celebrated by Horace, is known by reputation to every one who has had the happiness of a liberal education: it was strong and rough, and could not be drunk until it was ten years old: even then it was necessary to dilute it with a weaker wine. It was also medicinally used; but, according to the advice of Galen, not before it was twenty years old; after which time it became bitter and nauseous. Dr. Henderson‡ is of opinion that it resembled our Sherry. The *Signinum,* which was rough and astringent, was also chiefly used as a medicine.

As wine supports the vital powers, it has been usual to prescribe it in low and sinking states of the habit; but the indiscriminate use of it, even in such cases, is to be reprobated; as the exhaustion which follows its administration has often hurried on the issue which it was intended to prevent.

In continued fevers, wine is often, however, the only remedy upon which we can with confidence rely; but where there is much irritability present, all violent diffusible and transient Excitants are hurtful, as their first effects are followed by a correspondent debility; and much injury was consequently formerly done by the inconsiderate use of such agents. Wine, however, under proper management, is well adapted for the advanced stages of continued fever. Its exciting powers are of primary importance, and it is agreeable to the palates of most patients.

* The Pramnian formed the cordial in the draught administered by Hecamede to Machaon, when he received his wound.

"- the nymph, of form divine,
Pours a large portion of the Pramnian wine;
With goat's-milk cheese a flavorous taste bestows,
And, last, with flour the smiling surface strews;
This for the wounded prince the dame prepares."
Pope's Homer, ii, xi, 780.

† Capaciore affer huc, puer, scyphos,
Et Chia vina aut Lesbia;
Vel, quod fluentum nauseam coerceat,
Metire nobis Cæcubam.

‡ History of Ancient and Modern Wines, p. 91.

Various circumstances, however, are necessary to be attended to in its administration.

1. The habits of the patient must be known. If, during health, he has been in the daily use of wine, it will be more necessary, proper, and safe, than if his habits were abstemious.

2. Its use in continued fever is indicated by the advanced stage of the disease, by a frequent, small, and compressible pulse, symptomatic of great debility; by low muttering delirium, and by that twitching of the limbs which is known by the term subsultus tendinum.

3. The appetite, and desire for wine, must also be attended to. In continued fever, reason is often suspended, and instinct seems again to resume its sway; if the patient has, therefore, a strong instinctive desire for wine, it seldom happens that the indulgence of this is improper. Sir John Pringle pointed out strongly the necessity of attending to this desire: "when the low state of the fever," says he, "was present, the sick had frequent cravings for cordials and wine; they drank the wine greedily; but, when they were in a state in which the use of cordials was questionable, they were careless about the wine."

4. The effect of the wine must be watched. If it do not disorder the functions of the stomach, nor increase the heat of the surface, but fill the pulse and lessen its frequency, mitigate delirium, and remove restlessness, then we may conclude that it is not only proper, but absolutely requisite.

5. When the disease arises from contagion, when the pulse is languid, and the spirits are oppressed, and when there is no phlogistic diathesis, wine may be given in any stage, even in the earliest, of continued fever. The quantity must be determined by the judgment of the practitioner. A bottle of Rhenish or of sound Claret may sometimes be taken even by females unaccustomed to wine; but two bottles of the strongest wines have been administered with advantage. The powers of the healthy body to bear wine are no criterion of what may be borne in typhus fever. It should be given in small quantities and frequently repeated; and when advantage is obtained from its employment, it must not be rapidly withdrawn, but gradually diminished as the febrile symptoms abate and the system becomes more susceptible of its impression.

6. With regard to the kinds of wine, Claret and the Rhenish are more proper than the stronger wines in the early stages of fever; and the stronger, such as Port and Sherry, in the late or sinking stages. Port wine is to be preferred when there is a tendency to diarrhœa. Burgundy may be prescribed under the same circumstances; but it is expensive, and rarely employed as a medicinal wine in this country. The lighter wines tend rather to open than to confine the bowels; the stronger, to check diarrhœa. Sherry is less likely to disagree with the stomach than

Port wine; and it is always to be preferred where there is a tendency to the deposition of the lithates in the kidney. Madeira is nearly on a par with Sherry in reference to its Excitant influence; but, as it is a strong wine, its strength must always be kept in remembrance in prescribing it in fever.

7. The form of administering the wine will greatly depend on the condition of the stomach, and on the taste and inclination of the patient. If a dislike be taken to the wine, it should be warmed, sweetened with sugar, and slightly acidulated; and the lips of the patient moistened with it: by this plan he rarely fails, in a short time, to relish it, and to take the quantity that is necessary. In general, it is prudent to dilute wine, especially in the earlier stages of fever; and to many febrile patients it is most grateful when diluted with cold water. It is also very much so when given in the form of negus and of whey. In cases of obstinate intermittent fever, which have worn down the strength of the patient, wine is useful, as it tends to re-establish the healthy action of the nutritive functions, and to improve the vigour of all the organic tissues. Wine proves hurtful in neuralgic and in rheumatic affections.

Upon the whole, we may say of wine, as of every thing else, it is a medicine or a poison, according to the discretion and moderation with which it is used, and the skill and judgment which direct its medicinal employment. When it causes a quick pulse, restlessness, delirium, or even a dry tongue, with thirst, in fever, its employment should be discontinued: on the contrary, when it lessens the delirium, fills the pulse, removes subsultus tendinum, and induces sleep, its administration is not only safe, but it will undoubtedly prove salutary.

g. SULPHURIC ETHER.—ÆTHER SULPHURICUS.

L. E. D.

Sulphuric Ether is prepared by distilling equal parts, by weight, of Sulphuric Acid and Alcohol in a sand bath previously heated to 200°, and carrying on the distillation until a white fume begins to appear in the retort; at which time Sulphurous Acid is disengaged and oil of wine generated. On adding more alcohol to what remains in the retort, and continuing the distillation, an additional quantity of Ether is obtained*. The distillation should be commenced immediately after mixing the acid and the spirit. If proper means be adopted to add fresh alcohol to the acid, as the former is converted into Ether, the same acid will suffice for a large proportion of alcohol.

* An almost indefinite quantity might be procured by the aid of the same sulphuric acid, were the retort connected with a vessel full of alcohol, which would flow through a small tube into the boiling materials in the retort, so as to keep the boiling liquid always at the same level. Under such a plan, Ether would continue to be produced until the alcohol was so much diluted with water as to render the produce too weak to be worth obtaining.

Such is the general outline of the process for procuring Sulphuric Ether; but as, in this state, the product, besides pure Ether, contains also some alcohol which passes over before the mixture boils, a small portion of water, and sulphurous acid, one sixteenth of its weight of carbonate of Potassa is added to the Ether thus produced: this unites with the water and sulphurous acid; and, by a second distillation, pure Ether, the *Æther rectificatus* of the Pharmacopœias, is procured.

Pure Sulphuric Ether, sp. gr. 0.713, is perhaps the most volatile and inflammable substance in nature. Under the common temperature of the atmosphere it is converted into vapour, and in assuming this form produces great cold. Its sp. gr. as it is usually procured, is 0.730: but in its purest state it does not exceed 0.7237 at 55° Faht. It is colourless, has an agreeable odour, and a hot, pungent, sweetish taste, and gives neither an acid nor an alkaline reaction. Ether of the specific gravity of 0.730 boils at 98° under the usual pressure of the atmosphere: but in the vacuum of an air pump, it boils at a temperature far below the freezing point—40° below Zero; and the vapour into which it is converted has more than double the sp. gr. of atmospheric air, being to air as 2.586 to 1.000*. The congealing point of Ether is—46°: but, absolutely, pure Ether has never been congealed. This vapour, when approached by any incandescent body, inflames, burns with a bright flame, and deposites carbon; and, when united with oxygen, it explodes violently, forming water and carbonic acid. Ether, exposed to light in a vessel partially filled, absorbs oxygen, and acetic acid is formed. Water, when agitated with pure Ether, takes up one fourteenth only of its weight, or one tenth of its bulk; but Ether unites with alcohol, and the fat and the volatile oils, in all proportions. It has no action on the earths which are medicinally employed, nor on the fixed alkalies; but it combines in all proportions with pure ammonia. It dissolves corrosive sublimate, and abstracts it from any solution containing it; and it acts in the same manner with sesquichloride of iron; thence it may be employed for detecting small quantities of these salts in aqueous solutions: the Ether is agitated with the fluid, and, after being left at rest, is decanted off and evaporated; if any sublimate or sesquichloride be present, it will be left on the evaporation of the Ether. Ether dissolves Iodine and Bromine with decomposition; but it dissolves, without change, the fixed and the volatile oils, resins, bitumens, the white of egg, and the active principles of many plants†. Chlorine gas, passed through it, decomposes it, producing hydrochloric acid and carbonic acid.

In order to understand the rationale of the production of *Æther*, we must recollect that alcohol consists of 2 equiv. of

* Gay Lussac.

† One useful quality is due to Ether from its volatility: if a few drops be put into a damp phial, it quickly evaporates and leaves the phial completely dry.

Carbon, 1 of Oxygen, and 3 of Hydrogen. Now the process of the formation of Ether seems to depend on a change being effected by the acid on the alcohol, and, after that is over, a change on the acid itself. Thus the alcohol is divided into two parts; the first passes into a state of Ether by losing one half of its Oxygen and one sixth of its Hydrogen, and the new combination of its altered proportions of ultimate components produces the Ether. The changes which the acid undergoes are not yet well understood. According to this theory, Ether differs from alcohol merely in the difference of the proportions of the ultimate constituents. This is rendered evident by comparing the proportions of the constituents of the two bodies.

	Alcohol, two atoms.		Ether, one atom.		
Carbon	4 equiv. =	24.48	4 equiv. =	24.48	or 64.87
Hydrogen	6 —— =	6	5 —— =	5	13.51
Oxygen	2 —— =	16	1 —— =	8	21.62
	Equiv.	46.48	Equiv.	37.48	100.00

Abstract 1 of Hydrogen = 1
1—Oxygen = 8—9

Ether = 37.48 is left.

Or, two equivalents of alcohol are resolved into one equivalent of ether and one of water. It may also be viewed as constituted of

1 Etherine (4 C. + 4 H.), + 1 Water (H. + O.) = Ether.

According to the theory of M. Dabit*, the surplus Hydrogen and Oxygen lost by the two parts of alcohol may be thus accounted for: the 1 equiv. of Hydrogen causes the sulphuric acid to pass into the state of sulphuretted hydrogen; whilst the 1 equiv. of Oxygen unites with the second portion of the Alcohol and constitutes a new vegetable matter; the elements of which, reacting on the sulphuretted hydrogen, decompose it, and form sulphurous acid gas, carbonic acid gas, oil of wine, carbonated hydrogen gas, and the carbon which is deposited and forms the black residue in the retort†. Another hypothesis was proposed by Mr. Hennell, who supposes that when the sulphuric acid and the alcohol are merely mixed, *Sulphorinic* acid is formed; but when heated, this acid is decomposed, the two equivalents of sulphuric acid and one equivalent of oxygen, and one of hydrogen of the alcohol (forming water), remain in the retort, whilst the remaining components of the alcohol combined pass over as Ether. But a simpler mode of comprehending

* Ann. de Chimie. t. xxxiv, p. 289; and t. xliii, p. 101.

† The formation of a new acid in the production of Ether was discovered by M. Dabit of Nantes in 1800: he named it Sulpho-vinic Acid. Vogel and Gay Lussac suppose it to be a compound of hyposulphuric acid and a vegetable matter.

the theory of the formation of Ether is *to consider the composition of Alcohol and of Ether in reference to the proportions* of water and of olefiant gas which each contains. Thus, if we admit that Ether consists of two equivalents of olefiant gas and one equivalent of aqueous vapour, and that Alcohol consists of one equivalent of each, we can easily imagine that, by abstracting one equivalent of water from two equivalents of Alcohol, the result will be Ether, a dihydrate of olefiant gas; and this the action of the sulphuric acid on the Alcohol is well calculated to produce, owing to its powerful affinity for water*.

The purity of Ether is best determined by its specific gravity; but it is also determined by other means. Thus, if it redden litmus, or precipitate the solution of chloride of Barium, it contains sulphuric acid: if it produce a milky solution with phosphorus, it contains Alcohol†.

As a medicinal agent, Ether is a diffusible Excitant. When it is taken in large doses, it acts powerfully on the nervous system, causing vomiting and diarrhœa, increasing the force and the frequency of the action of the heart and arteries, and producing temporary intoxication. Like other diffusible Excitants, its effects are rapidly propagated over the system, and soon dissipated. Its exciting influence is probably augmented by its volatility, as it distends the stomach and bowels, and is thus applied to every portion of the sensitive surface. It is also probable that it is absorbed in its state of vapour, and is, consequently, directly applied to the nervous centres.

The diffusible nature of the stimulus of Ether renders it well adapted for producing sudden excitement; but as its effects soon disappear, the dose requires to be frequently repeated.

Ether has been used both as an external and an internal remedy. Externally, it acts either as a refrigerant, or as a counter-irritant, according to the mode of its application. Its rapid evaporation causes a sensation of cold: but when this is restrained, it acts as a topical excitant; thence it relieves toothache when applied to the jaw and retained on it by covering the part with the hand. In the same manner it eases earache, not caused by local diseases of the internal ear; and it is very beneficial in all rheumatic pains. Internally administered, Ether, in doses of twenty drops or more, in a glass of cold water, stimulates the gastric nerves, checks the vomiting which often occurs in dys-

* Ether is, also, regarded as the oxide of a hypothetical radical, termed Ethule; and alcohol being a hydrate of this oxide, the sulphuric acid, by abstracting 1 eq. of water from 2 eq. of alcohol, converts it into Æther. The formula of Ethule is C. 4, H. 5; by adding Oxygen, this formula becomes C. 4, H. 5, O. = 37.48.

† It is a curious fact in the history of Ether, that, in the directions of Valerius Cordus, for making it, in 1544, equal weights of alcohol and sulphuric acid are ordinary proportions still sometimes followed. The preparation seems to have been neglected till 1729, when it was revived by the description of Frabenius.

peptic affections, and *aids the digestive powers of the stomach. When given in smaller doses, frequently repeated*, its influence is decidedly cordial. It relieves the clavus hystericus; and, in fevers of a malignant kind, it is useful in allaying twitchings of the tendons, hiccough, and other symptoms dependent on the morbid state of the nervous system. It is beneficially prescribed on the approach of the accession of the paroxysm in intermittents; and it often succeeds in preventing the attack; or, if it do not at first effect so much, the return of the paroxysm is marked by slight fever only, without any rigor; and this gradually disappears by continuing the use of the remedy. The dose is f℈i in f℥xi of water, and it is given half an hour before the expected paroxysm.

M. Bourdier has employed Ether as a vermifuga. He gives a drachm of it in a glassful of cold decoction of the male fern: soon afterwards, two drachms, in a sufficient quantity of the same decoction, are administered as an enema, so as to fill the whole intestinal canal with vapour of Ether; and, in another hour, two ounces of castor oil are swallowed by the patient. The worms are thus first destroyed and afterwards expelled*. Ether may be administered either pure, in water, or it may be combined with the volatile oils or with resinous substances. The vapour, when inhaled pure, acts like nitrous oxide, causing transient intoxication; but when duly diluted, it is a useful and ready excitant in torpid conditions of the lungs. The medium dose of Ether is f℈i; and it is seldom given in larger doses, the repetition of the dose being more useful than its extent.

The only officinal combinations of Ether which operate as simple Excitants are the *Spirit of Sulphuric Ether*†, and the *Aromatic Spirit of Ether*‡. The former is composed of one part of Ether combined with two parts of alcohol: it is a limpid, volatile liquid; and, like Ether, it excites the living system, acting powerfully on the nervous system, as well as being absorbed. It is extremely useful, in low febrile complaints, in allaying nausea and vomiting and diminishing thirst, which it accomplishes by stimulating the salivary glands. The Aromatic Spirit of Ether, in addition to the Spirit of Sulphuric Ether, contains the volatile oils of cinnamon and of cardamoms, long pepper, and ginger. It is used as an Excitant instead of the pure Ether, and answers every purpose for which that medicine is prescribed.

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* Mem. de la Soc. de Med.

† Spiritus Ætheris Sulphurici. E. Liquor Ethereus Sulphuricus. D. Dose, half a fluid drachm to three fluid drachms.

‡ Æther Sulphuricus cum Alcohole Aromaticus. E. Dose, half a fluid drachm to one fluid drachm.

INORGANIC SUBSTANCES OPERATING AS EXCITANTS.

a. OXYGEN——OXYGENIUM.

The physical and chemical characters of Oxygen gas—for in that form only is it known to us—having been already pointed out, its physiological action and its therapeutical employment have now to be examined.

Oxygen gas, as a component of common air, is essential for the preservation of the life of all animated beings, at least those which respire, whatever may be the nature of their respiratory organs; whether cilia, stomata, spiracules, ramifying tracheæ, subcutaneous sacs, or lungs. But in every instance the excitant influence of Oxygen gas, when breathed undiluted, is so considerable that the nervous energy is soon exhausted, debility and collapse supervene, and death ensues. It is, however, difficult to explain whether in this case the fatal result is the consequence of mere over-excitement, or is in some degree dependent on the change produced in the chemical condition of the blood, which may be said to be arterialized in every part of the system. But, notwithstanding this injurious influence of breathing an atmosphere of pure Oxygen gas, this agent may be inhaled to a moderate extent by man, not only without risk, but with advantage in some states of the respiratory organs. Thus it has been found serviceable during the paroxysm of spasmodic asthma: it removes the feeling of suffocation, produces an agreeable sensation of lightness in the chest, and diffuses the blood more equably, so as to excite the cutaneous capillaries, and, consequently, to relieve the pulmonary congestion, which is the cause of the distressing symptoms that more or less accompany the paroxysm; but, beyond this transient benefit, it effects nothing. In cases of asphyxia, from immersion in unrespirable gas, artificial breathing, carried on with Oxygen gas, has in a few instances been tried, and has been found beneficial.

As a more general excitant, Oxygen gas has been administered in solution in water, under the designation Oxygenated Water, in atonic dyspepsia and some other diseases of diminished action*. The Oxygen is combined with the water under a pressure sufficient to enable that fluid to take up nearly half its volume of the gas†. This oxygenated water is drank to the extent of one or two pints daily: but it has not been much used;

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* A curious instance of the influence of this gas is recorded by M. Grille, a pharmacien at Macon, in 1799. He ascertained that not only the workmen employed in a mine of Manganese, where much Oxygen gas is always evolved, were free from scabies, but that workmen going there with scabies were rapidly cured.

† Pharmacopœia Universelle.

and its excitant properties are not of a character sufficient to recommend it as superior to many other more easily procured excitants.

b. CHLORINE.—CHLORINIUM.

The physical nature and properties of Chlorine gas have also been described. It is a more powerful Excitant than Oxygen gas, whether employed in the gaseous state, or in solution in water.

On the lower animals, whether inhaled or injected into serous cavities or into the veins, Chlorine operates as a violent irritant, causing topical inflammation of the surfaces to which it is applied, and death.

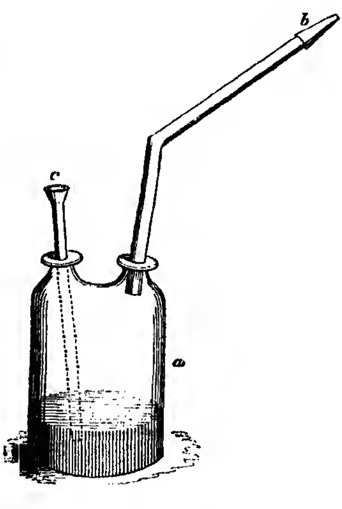
On man its influence is both topical and general, according to the manner in which it is administered. When applied to the entire skin, it causes a tingling or stinging sensation; and, if the hand be held in a jar containing it for ten minutes, besides the tingling which it excites, the skin is reddened, and the part perspires copiously; an effect which I have found is also slightly extended to the whole surface. If the hand be long retained in the jar, the skin becomes covered with small vesicles. Mr. Wallace, who employed it as a gaseous bath in affections of the liver, states* that its topical application, even when diluted with air, or combined with aqueous vapour, always reddens the skin, and is sometimes productive of a papular, sometimes of a vesicular eruption. When long and constantly inhaled, as in manufactories of chloride of lime and bleaching liquor, it induces irritative gastric dyspepsia, with emaciation, and a kind of aphthous affection of the mouth. It also produces a decided change both in the quality and the quantity of the saliva. It does not augment so much as might be supposed the force or the frequency of the pulse; and its primary action is followed by a soothing effect.

Chlorine, if attempted to be breathed in its undiluted state, does not enter the lungs, but produces a powerful spasm of the glottis; and if not immediately relieved, the person dies of suffocation. If death does not follow, acute laryngitis is apt to supervene. When diluted with a moderate portion of air, it excites violent coughing, irritation in the bronchial cells, great dyspnœa, tightness, and a painful, anxious sensation of the chest, which continues for several days. Yet, when largely diluted, this gas is a salutary excitant to the mucous membrane of the lungs. I have witnessed its beneficial effects in spasmodic cough and in asthma; and I have seen benefit result from its cautious employment in chronic bronchitis, and even in phthisis. In a much diluted state, it was first proposed to be employed in these diseases by Dr. Favart, of Marseilles, in 1804. His ex-

* Researches on the Medicinal Powers of Chlorine.

planation of its action is, "that by irritating in a peculiar manner the mucous membrane, it draws towards that organ the matter gorging the pulmonary parenchyma; and thus it relieves the lungs in severe chronic catarrh. It is unnecessary to comment on the improbability of this hypothesis. Soon after this period, I had an accidental opportunity of witnessing its beneficial influence in a severe case of epidemic catarrh, in which it was extricated as a fumigation to check infection: but it was not employed, either on the Continent or in this country, by more than one or two physicians, until a report of Dr. Cottereau, to the Faculty of Medicine of Paris, again brought it before the profession.

Several trading chemists, and particularly M. Gannal, had remarked that phthisical persons, who engage themselves to work in the manufactories of bleaching liquor, in which Chlorine is extricated, gradually but evidently improve in health; and, to confirm his observations, he constructed an instrument for inhaling this gas, and actually administered it as a remedy in phthisis. The success of the experiment surprised M. Gannal; but, not being a medical man, he mentioned his views to Dr. Cottereau, who pursued the same plans as M. Gannal, and with a degree of success sufficient to merit the attention of the profession. As far as my own experience has enabled me to offer an opinion, Chlorine forms a useful auxiliary in the treatment of chronic catarrh, humoral asthma, and even phthisis. In the two former diseases I have relieved several individuals by its means: and, in all cases of phthisis in which I have employed it, the palliation of symptoms has been considerable; but none of them have been cured.



For the purpose of inhaling, Chlorine should be extricated from the saturated aqueous solution of the gas, by putting fʒi or fʒii of it into a tubulated bottle: *a*, fitted with a bent tube, furnished with an ivory mouthpiece, *b*. The bottle should contain about f℥ii of hot water, and through a long funnel, *c*, which should reach the bottom, and be fitted to the tubular orifice or mouth through which it passes, the charge of the solution should be introduced. The bottle should then be placed in a basin of hot water, in order to extricate the Chlorine from its aqueous solvent. In phthisis, the charge of the solution should not at first exceed ten or twelve minims: but it may be gradually

increased to the extent already mentioned. The patient should inhale this quantity at one time, and the dose should be repeated once, at least, every six hours, so as to maintain the effect produced on the mucous membrane. When thus cautiously inhaled, the first effect is a slight sense of constriction in the trachea and some increase of cough: in a few instances, a degree of vertigo has been experienced, and tightness across the chest: but these feelings rapidly subside, and the patient feels generally more comfortable than before inhaling the gas, and the sputa are expectorated without any effort. In those cases of asthma in which I have seen the Chlorine used, the relief has been peculiarly striking; and in phthisis the symptoms of hectic have abated during its employment; so that, in cases in which a fatal termination of the disease has occurred, the Chlorine may be said to have "scattered flowers on the borders of the grave." Its influence can only be explained on its stimulant power producing a new action in the morbid organ; which, if it could be maintained sufficiently long, might assuredly palliate, if not overcome, the diseased action; and, by the assistance of other means calculated to support the tone of the habit without exciting fever, the disease might be cured. In cases where large vomicæ exist, it is in vain to expect a cure from any means; but when we consider the powerful influence of Chlorine in checking putrefaction and in promoting the cure of external ulceration, it is not, in my opinion, a vain speculation to expect advantage in ulcerated lungs from this mode of employing it. I have found it more useful to extricate it slowly from Chloride of lime, in the sick-room, than to inhale it.

Like every other powerful gaseous excitant, Chlorine, when inhaled without being sufficiently diluted, produces a severe sense of strangulation, which recurs at intervals of two or three minutes, and is momentarily relieved by a tendency to syncope, during which the air in the lungs is changed. These recurring strangulations are accompanied by violent irritating coughing; and individuals have fallen down in a state of complete syncope who have suddenly taken a large draught of it. Such violent effects, however, are in general only temporary: few instances have occurred in which inflammation of the lungs and air tubes have supervened. Indeed, the system soon accommodates itself to Chlorine; the workmen in chemical manufactories breathe it daily with impunity*. The best method of overcoming its deleterious effects is to inhale warm aqueous vapour, through a large sponge dipped in boiling water. On an occasion, when I accidentally inhaled a large quantity of it, after employing ether,

* Mr. Tenant, one of the greatest manufacturers of bleaching liquor, has informed me that men affected with chronic cough, who apply to him for work, invariably lose their coughs when cautiously brought into the gas-house.

spirit of wine, and ammonia, without any benefit, the warm aqueous vapour afforded immediate relief.

CHLORINE WATER. *Aqua Chlorinii.* E. D.—This preparation is procured by merely passing a stream of Chlorine gas, extricated by the usual means, through cold water, which, under the ordinary pressure of the atmosphere at a temperature of 60° Faht. takes up about twice its bulk of the gas. The solution is of a greenish-yellow colour, has the odour of the gas, and a disagreeable styptic taste, and bleaching properties. Its sp. gr. is 1.003. If kept, it should be excluded from the light, as the moisture, with which it is always combined, is decomposed, the oxygen is evolved, and the hydrogen uniting with the chlorine form hydrochloric acid.

In the concentrated form, when taken into the stomach, the solution of Chlorine operates as a violent poison: but, when duly diluted, it exerts a salutary excitant influence on the habit labouring under some forms of disease. It is used topically and generally. In 1816, Brugnatelli proposed to employ it as a lotion to wounds from the bite of rabid animals, and at the same time to administer it internally in doses of f℥ii, four or five times a day, for many successive weeks. Several successful cases were recorded by him*, and his observations were confirmed by Arragoni†, Chevalier, Schœnberg, Simmola‡, and others; but later experience has not confirmed their accounts. Its utility is less problematical as a lotion in scabies, and as a gargle in malignant sore throat; or an injection in the corroding œzena which attends malignant scarlatina. In the latter affection, I have seen the discharge not only improved in its quality and soon altogether checked, but the most striking improvement in the habit produced by injecting into the nostrils f℥i of the solution in f℥i of water, three or four times a day: and on the same principle it has been used as an injection, also, in cancer of the uterus; as an enema in the last, ulcerative stage of dysentery; and applied, in a more concentrated state, to foul, flabby ulcers. It corrects the fœtor of the discharge, and, by the excitement which it affords, cleans the ulcerated surface; and, when it is not of a malignant character, assists cicatrization.

Internally, the solution has been advantageously administered, in doses of from f℥i to f℥ii, largely diluted; in typhus attended with putrid symptoms, malignant scarlatina, and in diseases of the liver. It has also been prescribed in syphilis; but its beneficial influence in that disease has not been confirmed.

As the albumen of the egg is instantly coagulated by Chlorine water, thence Dioergie§ has recommended it as an antidote in

* Journ. Gen. de Med. t. lix, p. 303.
† Bulletin de la Soc. Med. d' Emulation, Fev. 1823, p. 127.
‡ Bulletin de la Sciences Med. de Ferrusac, Mai 1828.
§ Médecine Légale theorique et pratique, t. ii, p. 634.

poisoning by Chlorine. It forms a white, curdy, insoluble matter, which is easily ejected from the stomach by tepid water and the ordinary means of exciting vomiting. The gastric inflammation is to be combated in the usual manner. In a case which came under my observation, Magnesia was administered with decided advantage.

Chlorine enters into two officinal preparations, namely, Chlorinated Lime*, and the solution of Chlorinated Soda†. The disinfecting property of Chlorine will be treated of in its proper place.

c. Iodine.—*Iodinium.* L. D. *Iodineum.* E.

The nature of this elementary substance, and its chemical properties, have been already described. It is therapeutically employed both in its *uncombined* and *combined* state.

* *Uncombined.*

Iodine operates as a powerful Excitant, entering the circulation and stimulating in a special manner the capillary system. On the lower animals, especially dogs, on whom my experiments have been made, its action is far from being energetic: and, unless the dose be very large, as in Dr. Cogswell's Experiments‡, death has rarely been the result. Its primary action is exerted upon the stomach and intestinal canal—a fact which has been fully ascertained by its effects upon persons who have taken it in overdoses, as well as from the vomiting which it always excites in dogs to whom it has been administered in large doses. Indeed, from the powerful manner in which it attacks the skin, even when largely diluted, its stimulant influence, when internally administered, might have been prognosticated. It tinges the skin orange-red, an effect accompanied with heat, great tingling, and desquamation. Pure Iodine, or the Tincture, when taken into the mouth, in moderate doses in solution, impresses a sensation of acrimony in the throat, which extends to the stomach and other digestive organs, awaking appetite and promoting the gastric function: but, even in small doses, namely, a quarter of a grain, frequently repeated, it sometimes proves deleterious, in consequence of its absorption and accumulation in the system; for, like some other remedies, particularly Foxglove, it may remain inactive for a time, and then suddenly display its powers with violence. Its absorption is so evident,

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* Calx Chlorinata. L. E. † Liquor Sodæ Chlorinatæ. L.

‡ Experimental Essay on Iodine, 1837.

that its presence can be detected in the blood, in the urine, and in the perspiration, in less than an hour after it is swallowed, It appears to be changed in the system into an Iodide, for the above-mentioned fluids have no property of blueing starch, until chlorine is poured upon their surface to decompose the Iodide, and set the Iodine free. It is supposed that the nervous plexuses and the great sympathetic nerve are particularly acted upon by Iodine; but its chief influence, as an Excitant, is undoubtedly exerted upon the capillary and secreting system, which it appears to urge to unusual activity; both the saliva and the urine are augmented in quantity: and the uterine secretion is also influenced. Its action on the salivary glands has been denied; but I have seen salivation caused by it in four instances. Its influence, however, on these glands is only shared by them in common with the whole capillary system. During the continued use of Iodine, all the organic tissues are said to be more or less affected, particularly the mammæ in women, and the testicles in males, which waste: and no gland in the body is exempt from the action of Iodine. I have never witnessed this effect. M. Lugol, also, has observed a most remarkable discrepancy in the action of Iodine; namely, that women labouring under scrophula, instead of becoming emaciated, as is common during a course of this medicine, gain flesh; and Majendie has observed similar effects to occur. This, however, is no argument against the specific influence of Iodine on the capillary system. When an overdose is taken, the symptoms are heat and a sensation of weight in the epigastrium, pain at the bottom of the sternum, particularly when pressure is made upon that part, cardialgia, great restlessness, burning heat of the skin, excessive thirst, and frequent purging of dark bilious matter; the pulse feels weak and tremulous; palpitations supervene, with frequent syncope and extreme exhaustion. In irritable habits, even when the dose is not so large as to deserve the epithet overdose, it causes a febrile excitement, often accompanied with nausea, vertigo, and headache; and, occasionally, with symptoms which resemble those of inebriety, followed by stupor and shaking palsy.

Among the other effects attributed to the influence of Iodine, it is supposed to be aphrodisiac; but, if the statements of the results of its emaciating power be true, such an effect is incompatible with that property and the debility which accompanies its operation. This emaciation and debility were first observed by Dr. Coindet, who termed it *Iodism*. The symptoms which it displays are fever, thirst, emaciation, vomiting, purging, dry cough, great depression of strength, and sinking on the least exertion, suddenly terminating in death. I have witnessed two cases of this description; and Sir B. Brodie met with one in which the patient died in returning from the night-chair to his bed. It is probable,

however, that such cases are connected with some peculiarity of habit or idiosyncracy, permitting the Iodine to accumulate in the habit, to an extent which may be termed saturation. That the remedy is absorbed is undoubted, and such an accumulation may readily occur in the same manner as with Mercury or Digitalis. On the other hand, it is as remarkable that very large doses of Iodine have been taken without any obvious influence on the habit. Dr. Kenney of Glasgow carried the dose of the Tincture to eighteen grains a day without any evident injurious effect*.

In post-mortem examinations of cases of poisoning by Iodine, the mucous membrane has been found inflamed and sphacelated; the liver enlarged and of a pale rose colour†. Thence it appears to operate as an irritant poison.

Simple Iodine has been prescribed in the form of pills; but there are many objections to its administration in substance; thence it is generally given in the tincture‡, which is merely an alcoholic solution of Iodine, in the proportion of two scruples of the Iodine to one ounce of Rectified Spirit; each f℥i containing gr. v of Iodine. But, in the officinal Tincture of the Edinburgh College, ʒss only is contained in f℥i§. This solution is opaque, of a deep brown colour, exhaling the odour of Iodine, and impressing a very unpleasant taste on the palate. M. Lugol employs an aqueous solution of Iodine, which contains from half a grain to a grain of Iodine in a pint of water, held in solution by twelve grains of Chloride of sodium.

The usual dose of the tincture is ten or fifteen minims: but it may be gradually augmented until sixty minims be taken three times a day. The dose of Lugol's aqueous solution is a fluid ounce and a half.

The London College orders a Compound Tincture‖, in which the Iodine is held in solution in Rectified Spirit by means of Iodide of Potassium: one fluid ounce contains gr. xii of Iodine and gr. xxiv of Iodide of Potassium.

** *Combined Iodine.*

Iodine combines readily with Starch, Sulphur, Potassium, Iron, Mercury, Lead, Zinc, and Arsenic, forming medicinal Iodides, which greatly modify its action, as will be pointed out under the head of these various substances. I shall here only notice the mode of preparing a few of them.

Iodide of Amidine.—Dr. Buchanan, who first used this combination, therapeutically, directs it to be prepared by rubbing

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* Cogswell's Essays.
† Zink. Journ. Complement, t. xviii.
‡ Tinctura Iodinii. D. Dose, six minims to half a drachm.
§ Tinctura Iodinii. E. Dose, nine to forty-five minims.
‖ Tinctura Iodinii composita. L. Dose, half a fluid drachm to one fluid drachm.

together, with the aid of a little water, gr. xxiv of dry Iodine and ℥i of pure Starch; and, lastly, drying the compound with a gentle heat. The dose should be small at first,—namely, ʒss; but Dr. Buchanan has carried it to the extent of ℥i three times a day. It operates in the same manner as Iodine, but milder.

IODIDE OF SULPHUR. *Iodidum Sulphuris.*—This is formed *by rubbing together eighty-eight parts of Iodine and twelve parts of Sulphur, and exposing the mixture to a moderate heat.* The product has a dark, lamellated structure, not unlike metallic Antimony, and exhales the odour of Iodine. It has been employed merely as a local Excitant.

IODIDE OF POTASSIUM. *Potassii Iodidum.* L. E.* *Hydriodas Potassæ.* D.—This Iodide may be prepared in various ways. To a warm solution of pure Potassa add as much Iodine as it is capable of dissolving: this forms a brownish-red fluid which contains Iodate of Potassa and free Iodine; evaporate to dryness and expose the dry mass, in a platinum crucible, to a red heat, to convert the Iodate into Iodide of Potassium. The fused mass is then to be dissolved out by water and crystallized. But the simplest mode of making it is that now adopted by the London and the Edinburgh Colleges; namely, to decompose the solution of Iodide of Iron with Carbonate of Potassa, and evaporate the filtered fluid to the point of crystallization. The solution is colourless, slightly acrid, and bitter. When it is evaporated and crystallized, Iodide of Potassium is procured in semitransparent cubes. This salt is fusible and sublimes unchanged at a red heat: it is deliquescent, consequently very soluble, requiring two thirds only of its weight of water, at 60° Faht. for solution. It is also freely dissolved by alcohol, and contains no water of crystallization. It is a compound of 1 eq. of Iodine, 126.3 + 1 eq. of Potassium, = 39.15, equiv. = 165.45.

As a local application, this preparation, in conjunction with Iodine, is formed into an ointment with lard, and employed with advantage as a friction over scrofulous tumors. The strength of the ointment is two parts of the Iodide, one part of Iodine, two parts of Alcohol, and sixteen parts of Lard†. The ointment of M. Lugol is double this strength.

The presence of Iodide of Potassium in water or any solution, or in the animal secretions, is instantly detected by mixing the fluid with starch and pouring chlorine gas on it: the Iodine is set free, and its presence demonstrated by the blue colour produced‡. It is decomposed by solution of Bichloride of Mercury, which precipitates the vermillion-red Biniodide of Mercury: by Acetate of Lead, which forms the golden yellow Iodide of

* Potassii Iodidum. L. E. Dose, three minims to one drachm.
† Unguentum Iodinii compositum. L. Unguentum Iodinei. E.
‡ This ready mode of testing was proposed by me in 1835.

Lead: by Nitrate of Silver, throwing down the Iodide of Silver: and with Protonitrate of Mercury, to form the greenish-yellow Protiodide of Mercury.

Iodide of Potassium is often adulterated with Carbonate of Potassa,—this may be readily detected by dissolving the suspected specimen in alcohol. The Iodide only will dissolve. *This detects the quantity of the adulteration: that it is Carbonate* of Potassa, is discovered by Bitartrate of Potassa being formed and Carbonic acid evolved, when Tartaric acid is added to the solution. To detect the Chloride of Sodium, add to the solution Nitrate of Silver and digest in liquor Ammoniæ: then filter, and if, on the addition of Nitric acid, a white precipitate be procured, we may conclude that the Chloride was present.

As therapeutical agents, Iodine and Iodide of Potassium operate nearly alike; and both have proved successful remedies in bronchocele, and in scrophulous affections*. In bronchocele, their influence depends solely on the nature of the tumor: when it is complicated with solid deposites in the gland, neither Iodine nor Iodide of Potassium are the proper remedies; and it is scarcely necessary to say that the same opinion may be given if a scirrhous tendency exists in the gland. It is in simple bronchocele that both may be confidently depended upon. Their internal administration is greatly aided by their external application in the form of ointment, which should be rubbed upon the tumor night and morning.

In scrofula, the advantages to be derived from the excitant influence of Iodine and Iodide of Potassium on the lymphatic system have been clearly ascertained. The most successful cases were treated by M. Lugol, Physician to the Hospital of St. Louis, in Paris: of 109 cases, 36 were completely cured, and 30 relieved. I have not seen the same striking advantages result from the employment of Iodine, either alone or in combination with Iodide of Potassium, in my own practice: but I have observed the most striking success attend the employment of the Iodide of Iron in such cases.

In that modification of scrofula, in which the glands of the mesentery are chiefly involved, little advantage has been derived from Iodine or the Iodide in any form. Both have been found beneficial in chlorosis, amenorrhœa, leucorrhœa, and syphilitic cachexia. M. Barbier and some other Continental physicians suggested the propriety of employing Iodine and its preparations in hypertrophy of the heart; but he candidly acknowledges that his hopes were disappointed. In the Hotel Dieu, where cases of hypertrophy frequently occur, no advantage whatever resulted from the employment of Iodine or Iodide of Potassium.

* Lugol, Mem. sur l'Emploi de l'Iode dans les Affect. Scroph. Paris, 1829.

Iodine and the Iodide have been proposed as remedies in phthisis, under the idea that they might cause the absorption of the tubercles, and remove the indurated state of the pulmonary tissue. They have also been suggested as likely to arrest the accession of the paroxysm in gout, by M. Gendrin; but experience is required to verify these proposals.

In reasoning upon the causes and the nature of ovarian dropsy, I was induced to think that, as the tension of the cyst is probably that state which is natural to, and consequently most favourable for, the morbid enlargement of the diseased organ, and that, whilst this remains, the vitality of the part would always enable it to resist any effort for its removal by the action of remedial agents on the absorbents; but that, were this tension removed, and the cyst to remain flaccid, it would then be nearly in the state of a foreign body within the abdomen; and a powerful excitement of the absorbents might be able, if not wholly to remove it, at least so to change the action necessary for its growth as to keep the disease stationary. No Excitant appeared so well adapted to fulfil these intentions as Iodine; I therefore resolved, immediately after tapping, to throw in as much Mercury and Iodine as the stomach would bear; at the same time, aiding its action by friction over the abdomen with the ointment of the Iodide of Lead. Of five cases treated in this manner, three have been arrested in their progress. In these instances, the dose of the tincture was carried to the extent of sixty minims, three times a day.

Iodine and its combinations have been, also, used beneficially in enlargements of the liver and the spleen: in leucorrhœa, when no excitement is present: in the secondary form of syphilis; and in incipient cancer, in which I have seen the utmost benefit derived from it. I am sceptical as to the propriety of inhaling its vapour in Phthisis and Chronic Bronchitis.

With regard to the value of the three above-mentioned preparations of Iodine, all of them are powerful Excitants: they combine the properties of the substance united to the Iodine with those of that substance, and operate accordingly. Thus the Iodide of Sulphur operates more decidedly on the skin than either Sulphur or Iodine alone: and the same may be said of all the Iodides, whether externally or internally employed. But, under whatever form Iodine is administered, its effects must be closely watched; and the use of the remedy suspended on the first appearance of any untoward symptom*.

A natural combination of Iodine is found in cod-liver oil,

* On the subject of Iodine and its preparations, the student may consult the following works: *Manson*, on the effects of Iodine in Bronchocele, &c. London, 1825.—Archives de Med. tome iv. p. 321.—*Boullay*, Ann. de Chimie et de Phys. 1827. *Lugol*, Mem. sur l'Emploi de l'Iode, &c. Paris, 1829. *Lugol*, Mem. sur l'Emploi des Bains Iodurets: Paris, 1830.

Oleum Jecoris Aselli, a substance which has been immemorially used as a popular remedy in rheumatism*.

There can be no doubt of the antidotal powers of Iodine in cases of poisoning by Strychnia, Brucia, Veratria, and Aconita. In these cases the tincture is employed.

d. BROMINE. *Brominium.* L.

The physical and chemical properties of this substance having been already described, it is now only necessary to investigate its physiological action on the animal system. It is seldom prescribed in its *simple* or *uncombined* state.

* *Uncombined.*

Simple Bromine operates as a powerful excitant on the animal frame of man. When it is applied to the skin, it stains it yellowish-brown, and causes a sensation of pricking on the part; reddens and inflames it. If the vapour is attempted to be inhaled, it excites violent coughing, accompanied with vertigo and a sensation of suffocation. When taken into the stomach moderately diluted, it first acts topically, causing a sensation of heat at the epigastrium, colic pains, nausea, hiccup; and then is taken into the circulation, and influences the capillaries; causing an augmentation of the salivary secretion. It is said, also, especially to influence the uterine secretion. In other respects, Bromine operates very much in the same manner as Iodine.

In its simple state, Bromine may be administered in solution in water, in the proportion of 1 part of Bromine by weight and 40 of distilled water. The dose of this solution is 5 to 6 minims, in a glass of water, sweetened with sugar. This simple solution is sometimes used as a lotion for external application.

Bromine in large doses is an active poison; a fact which has been demonstrated chiefly by the experiments of Butske, Dieffenbach, Barthez, and Franz. Administered in doses of forty and sixty drops to dogs, it causes restlessness, embarrassed breathing, vomiting, dilated pupils, stupor, and convulsions; which are followed by collapse, and generally terminate in death in four or five days. The post-mortem examination of the body displays evidences of the powerful irritant properties of the poison, by the degree of gastric and intestinal inflammation, arising sometimes to ulceration of the stomach. When injected into the veins, it coagulates the blood, causes tetanic convulsions, and almost immediate death. From these symptoms and appearances, it is difficult to say how much is due to the topical, how much to the general influence of the Bromine. The

* Bennet on the Oleum Jecoris Aselli, 8vo. London, 1841.

dilated pupils, the stupor, and convulsions, indicate some influence on the nervous centres.

Magnesia has been recommended as an antidote by Barthez. The general symptoms, however, of poisoning by Bromine, should be treated in the same manner as poisoning by Iodine.

*** Combined.*

Bromine combines readily with metals; but it is only to one of these combinations,—namely, Bromide of Potassium,—that our attention requires at present to be directed.

1. Bromide of Potassium. *Potassii Bromidum.* L.—This salt exists ready formed in sea water and in brines, as the Bromides of Sodium and of Magnesium; but for medical use it is prepared by decomposing the Bromide of Iron with Carbonate of Potassa. The London Pharmacopœia, in which only it is officinal, orders, first, a Bromide of Iron to be made by putting an *ounce* of iron filings into a pint and a half of distilled water, and adding *two* ounces of *Bromine*. This mixture, after standing for half an hour, and being frequently stirred, is to be digested in a gentle heat until it acquires a green colour; after which it is to be decomposed by two ounces and one drachm of Carbonate of Potassa dissolved in a pint and a half of distilled water. The Carbonate of Potassa is immediately decomposed and its Potassa yields its Oxygen to the Iron, converting it into an Oxide, which combines with the Carbonic acid and forms an insoluble Carbonate of Iron, whilst the freed Potassium combines with the Bromine and constitutes the Bromide of Potassium, which remains in solution. By washing the precipitate with two pints of boiling distilled water and filtering the solutions, crystals are obtained by evaporation.

Bromide of Potassium crystallizes in white, semi-transparent cubes, or quadrangular prisms, containing no combined but some interstitial water. They are permanent in the air, decrepitate when heated, and fuse at a red heat without decomposition. This salt is inodorous, not unlike Chloride of Sodium, but more pungent or penetrating to the taste, soluble in water, and slightly soluble in alcohol. It is a compound of 1 equiv. of Bromine, = 78.4, + 1 equiv. Potassium, 39.15: equivalent of the salt 117.55: or of 66.1 of Bromine, + 33.9 of Potassium, = 100.0*. The purity of the salt is known by its not affecting either Litmus or Turmeric; or affording any precipitate with Chloride of Barium.

The solution of Bromide of Potassium is decomposed by Chlorine, which sets free the Bromine, and forms a Chloride with the Potassium. It affords precipitates of Bromides of

* Balard states the proportions to be Bromine 65.56, + Potassium 34.44, = 100.00; Liebig, Bromine 67.42, + Potassium 32.58, = 100.00.

Silver, Lead, and Mercury, when solutions of Nitrate of Silver, Acetate of Lead, and Protonitrate of Mercury are added to it, whilst Nitrate and Acetate of Potassa remain in solution. When the salt is pure, the solution yields no precipitate with Chloride of Barium*.

Bromide of Potassium operates both as a local and a general excitant. Its topical influence, when taken into the stomach, is felt upon the intestinal canal, exciting its peristaltic motion and causing diarrhœa. But its chief action, whether externally applied or internally administered, is upon the capillary system, which it excites to a degree equal to that of the Iodide of Potassium; and swellings of the lymphatic glands are reduced during its use. The idea, which originated with Dr. Williams†, that it has some specific influence on the spleen, requires confirmation. Its influence upon the kidneys shall be afterwards noticed.

Bromide of Potassium may be administered in the form of pills, in combination with Extract of Gentian or of Conium: but solution is a preferable form. The infusion of any bitter, not containing much tannic acid, may be employed as a vehicle for the solution. The dose must depend on the strength of the solution; but that which contains three grains to the drachm of fluid, is the best for extemporaneous prescription: it may be carried to ten grains.

The Bromides of Iron and of Mercury shall be noticed under the metals with which they are combined.

e. Gold, *Aurum*.

This metal is too well known to require a particular description. It has been, from remote antiquity, employed as a medium of exchange; and owing to its suffering scarcely any alteration from the influence of air and moisture, even when heated, it was at an early period employed in the formation of ornaments. It is found, generally, in the native or uncombined state‡; but sometimes in conjunction with platinum, silver, copper, tin, lead, and sulphurets of iron. Native gold is crystallized, capillary and massive: the crystals are either cubes or octohedrons, or some modification of these forms. In its pure state, it is soft, malleable§, extremely ductile||, and fuses at a temperature equal

* If a solution of gr. x of the salt take up more than gr. 14.28 of Nitrate of Silver, it is adulterated with Chloride of Potassium.

† Elements of Medicine, vol. i.

‡ In 1826, a mass of native gold, weighing twenty twenty-three pounds, was found in the mine Zarewo-Alexandrowsk, in Siberia.

§ One grain of Gold can be beaten into a leaf the 200,000th of an inch in thickness, and extending over 56 square inches of surface.

|| One grain may be drawn out to 500 feet of wire.

to 2016° Faht.: its sp. gr. is 19.3. The equivalent of Gold is differently stated by different chemists; I prefer that of my late lamented colleague, Dr. Turner, namely, 199.2. For therapeutical purposes it is employed in the forms of a Terchloride, an Auro-terchloride of Sodium, an Iodide, a Tercyanide, and an Oxide. Before mentioning its physiological action on the body, and its medicinal use, I shall examine each of the above salts, in the order in which they are named.

1. TERCHLORIDE OF GOLD, *Aúri Terchloridum,* is prepared by dissolving one part of Gold in three parts of Nitro-hydrochloric acid. The French Codex orders the solution to be evaporated until chlorine begins to be disengaged, and then set aside to crystallize. The solution, when first made, is of a yellow colour, which deepens to an orange-red by evaporation, and forms long, acicular, bright yellow crystals, deliquescent in moist, but permanent in dry air: indorous and impressing a strong, disagreeable styptic taste. The solution of these crystals reddens litmus, and is decomposed by many of the metals, Phosphorus, Protosulphate of Iron, Charcoal, Sugar, Gum, Extractive, and Tannic and Gallic acids. It stains the cuticle purple. It is a compound of 1 eq. of Gold, = 199.2, + 3 eq. of Chlorine, = 106.26, equiv. = 305.46.

2. AURO-TERCHLORIDE OF SODIUM, *Sodii Aúro-terchloridum.*—By adding 16 parts, by weight, of Chloride of Sodium to 85 of the Terchloride of Gold, dissolved in a small quantity of distilled water, this double salt is formed. The solution, evaporated to a pellicle, yields quadrangular, elongated, orange-coloured crystals, permanent in the air, when they contain no excess of the Terchloride of Gold. They are soluble in water, and are decomposed by heat, during which Chlorine is evolved, and Gold and Chloride of Sodium remain. They are composed of 1 eq. of Terchloride of Gold, = 305.46, + 1 eq. of Chloride of Sodium, = 58.72, + 4 of water, = 36, = 400.18.

3. IODIDE OF GOLD, *Aúri Iodidum.*—Iodine and Gold do not combine, even when aided by heat: but when the solution of the Chloride is added to a solution of Iodide of Potassium, both salts are decomposed, the Chlorine combines with the Potassium, forming a Chloride which remains in solution, whilst an insoluble Iodide of Gold is precipitated. It contains an excess of Iodine, which is readily removed by washing the Iodide, on the filter, with alcohol. When dried, this salt is of a greenish-yellow colour: it is insoluble in cold water; but soluble in alkaline solutions. It is a compound of 1 eq. Iodine, = 126.3, + 1 of Gold, = 199.2, equiv. = 325.5.

4. TERCYANIDE OF GOLD, *Aúri Tercyanidum.*—When a solution of Chloride of Gold, heated in a salt-water bath to drive off any excess of Chlorine, is dissolved in distilled water, and a solution of Cyanide of Potassium added until the precipitation

ceases; the precipitate is this salt. It is a yellow powder, insoluble in water; and consists of 1 eq. of Gold, = 199.3, + 3 eq. of Cyanogen, = 79.37, equiv. = 278.47.

5. PER OR TEROXIDE OF GOLD, *Aúri Teroxidum.*—This Oxide is prepared by boiling 1 part of the Terchloride of Gold with 4 parts of Magnesia in 40 parts of water. The precipitate, which is a mixture of Magnesia and Oxide of Gold, is to be first washed with water to abstract the Chloride of Magnesium which is formed, and then treated with dilute nitric acid to remove the Magnesia. The residue is a hydrate of the Teroxide of Gold, of a bright reddish-yellow colour, rapidly reduced by exposure to light; and insoluble in water. It has the properties of an acid; and forms aurates with Potassa, Soda, and Baryta. Its components are 1 eq. of Gold, = 199.3, + 3 of Oxygen, = 24, equiv. = 223.3.

All of these salts operate with much acrimony on the living body. Gold itself, in a state of minute division, like mercury, administered either alone, or in the form of an amalgam, exerts a considerable excitant influence on the habit, a fact which was demonstrated by Pitcairn, in 1714, and recently verified by M. Christien* of Montpellier, M. Niel†, Sig. Gozzi of Bologna‡, Le Grand, and other continental practitioners. Although its activity is very inferior to that of its salts, which have been described, yet, it seems to excite generally the capillary system, and to augment the secreting powers of the skin, the kidneys, and other glands.

All the salts described, when internally administered in small doses, excite a topical irritation upon the mucous surface; and, being absorbed, set up fever in the system, even in doses of one tenth of a grain. They cause gastric irritation, a dry, red tongue, soreness of the fauces, colic, and diarrhœa: but it is stated that, when they are rubbed upon the tongue, they operate upon the capillaries, perfectly independent of any local irritation.

On the *digestive organs* the preparations of Gold, in minute doses, operate as tonics, improving the appetite, and aiding the function of the stomach,—a circumstance more striking in those weakened by disease. They cause constipation, which may be explained by the augmented absorption which they excite.

On the *nervous system.*—The evidence of the influence of these salts on the nerves is displayed by the augmented mental energy which follows their employment, their aphrodisiac effects, and their influence on the uterine secretion.

The febrile action, set up in the habit by the salts of Gold, closely resembles that caused by the administration of Mercury:

* Sur un nouv. Remede dans le traitm. des Mal. Vener. Paris, 1811.
† Rech. et Observ sur les effects des prepar. d'Or. Paris, 1821.
‡ De l'Or, de son emploi dans le trait. de la Syphilis. Paris, 1832.

it is accompanied with copious perspiration; sometimes an increase of the renal secretion*, and occasionally salivation, but differing from that caused by Mercury, as the gums are neither swelled nor painful. This febrile action has been regarded by those physicians who have employed the salts of Gold as their curative power, when prescribed in secondary syphilis. From which opinion they mean to imply that these salts exert a specific power in the cure of syphilis; a position with which I cannot accord: and I have no hesitation in referring the salutary influence which they display, to their excitement of the capillary system and setting up a new action in it, sufficient to overcome the previously existing morbid action.

In the administration of the salts of Gold, much caution is requisite. If heat of skin, cephalalgia, dryness of the mouth and throat, and any indications of gastric irritation supervene, the dose must be instantly diminished, or the use of the preparations discontinued. Sometimes an eruption resembling eczema appears, with periostitis, very similar to that caused by Mercury. There is, however, no doubt of the value of the salts of Gold in syphilis. On the same principle, namely, exciting the capillaries, the salts of Gold have been administered internally, and also externally applied in scrofula; and they have been productive of salutary effects, but not to the extent stated by Christien and other writers on the influence of these salts. They have, also, been found to exert a powerful action on the uterus, and to renew the catamenial secretion, when defective, or retarded as in Amenorrhœa. In ulcerative affections of the uterus, the Terchloride has been applied to the os uteri, both in the form of lotion and that of ointment. As a lotion, the Terchloride with Sodium has been used in the proportion of one grain of the salt to f℥ii or more of distilled water.

With respect to the mode of administering these preparations, the most approved is friction on the tongue, which is preferred to the gums or the cheeks, as the salts of gold blacken the teeth. A quarter of a grain should be used at first; but the quantity may be gradually extended to four grains in the day. Le Grand recommends the following lozenges:—

℞ Auri Oxidi, gr. vi,
Sacchari albi pulv. ℥i;
Tere et misce, dien adde Muc. Tragacanthæ, ut fiat moles, in pilulas sexagenta dividenda.

Each lozenge contains one tenth of a grain of the Oxide, and the dose may be repeated so as to allow one or two grains to be taken in the course of a day.

The *Terchloride of Gold and Sodium*, being more acrid than

* Gozzi *sopra l'uso di alcuni remedii aurefici.* Bologna, 1817.

the Oxide, requires to be more obtunded; and the best mode is to mix it with powdered Starch. The thirtieth of a grain is sufficient to be rubbed upon the tongue at first; but this may be repeated four or five times a day. In this method of employing it, the dose has been carried to a grain. In the operation of rubbing the medicine on the tongue, its excitant influence is displayed by the augmented flow of saliva, induced by its topical action on the salivary glands. This Terchloride has, also, been applied with equal advantage to the soles of the feet, in the form of an ointment made with ʒiv of the salt and ℥iv of lard: a drachm of which is used in each application. The remaining preparations may be employed in the same manner as this Terchloride; and we are told that, in the treatment of syphilis, it is of use, occasionally, to change the preparation.

I have had no experience in the employment of the Salts of Gold; consequently the facts here advanced are stated on the authority of the continental physicians who have written upon the subject.

f. MERCURY*. *Hydrargyrum.* L. E. D.

Mercury was known to the ancients, and used by them in the art of gilding and for other purposes†. It was, however, regarded by them as a poison‡, and consequently not therapeutically employed; and it was the attempt of the alchymists to render this metal solid which produced an examination of its chemical qualities, and originated the discovery of its medicinal properties: it was first medicinally employed by Avicenna and Rhases. Its properties as a metal have been already detailed.

In its metallic form, Mercury exerts no influence on the animal frame§; at least, when it is not very minutely divided. In the state of vapour, or in very minute division, Orfila and many others regard it as an active medicinal agent: an opinion in which I cannot altogether accord. Indeed there is no method of determining the fact; and the facility of the oxidizement of Mercury in a state of minute division cannot be denied. It must be combined with either Sulphur, or Iodine, or Chlorine, or Cyanogen, or Oxygen and acids, before it can operate upon

* I have not been able to trace the origin of the name Mercury; but it probably arose at that period when the science of Chemistry and the art of healing were both encumbered with the ceremonials of Religion and the mysticisms of Astrology; thence the metals were placed under the influence of the planets.

† Aristotle describes a wooden Venus, which moved by means of Quicksilver; *αργυροςχυτος*, literally *liquid silver*, which was made by Dœdalus, who lived 1300 years before Christ. It is supposed he was taught this art by the priests of Memphis.

‡ Paulus Egeneta, lib. vii, c. 3. Arctuarius, lib. v, c. xii.

§ Numerous instances are recorded in which pounds of metallic Mercury have been swallowed, without any effect, except mechanical irritation.

the living frame. When combined with these substances, it enters the circulation, exciting powerfully the whole of the glandular system, and increasing, in a remarkable degree, both the secretions and the excretions.

In preparing Quicksilver for medicinal purposes, the first object is to ascertain its purity; for, although it is brought pure into this country, yet it is sometimes, afterwards, adulterated with Lead. Pure Mercury is brilliant, and does not tarnish when exposed to the air; and when rolled upon a clean earthenware plate, it leaves no trace or tailing behind it. To detect the adulterations, a portion of the suspected Mercury must be well shaken with a little distilled water; then digested in some distilled vinegar, which does not act on pure Mercury, to dissolve the oxide of lead formed by the action of the water. If, on shaking this fluid with a solution of sulphuretted hydrogen, it throws down a black precipitate, we may conclude that lead is present in the Mercury. To determine the quantity of the adulteration, a solution of sulphate of soda must be added to the acetate, and the precipitate dried: 100 parts of the dry sulphate indicate 72 per cent. of lead. Mercury readily amalgamates with Lead in any proportion: when the quantity is small, the appearance of the metal is little altered: and a much larger quantity of lead may be held in solution by Mercury without diminishing its fluidity, if Bismuth be also present. The Bismuth is readily detected by pouring distilled water into the solution of the suspected metal in nitric acid, when a white precipitate falls down.

The first substance which I shall notice, as giving activity to Mercury, is *Sulphur*.

* *Mercury with Sulphur.*

We find that sulphur is combined with Mercury both with and without the aid of caloric. In the first, simple trituration of equal weights of mercury and of sulphur is continued until all the metallic globules disappear and a uniform black powder is produced, which is insipid and inodorous. This is the

BLACK SULPHURET OF MERCURY. *Hydrargyri Sulphuretum cum Sulphure.* L. *Hydrargyri Sulphuretum Nigrum.* E. L.—The rationale of the operation is not well understood. It was maintained by Fourcroy that the metal is imperfectly oxidized; but this opinion was refuted by Proust, by a set of admirably conceived and satisfactory experiments. It is now a well-established fact, that a direct combination between a metallic oxide and sulphur is a rare occurrence. It is probable that the Mercury unites with its full complement of sulphur, and is formed into a Bisulphuret of Mercury, which, in the entire preparation, is united with some uncombined sulphur. This

opinion of its composition is confirmed by the fact, that, by boiling the Black Sulphuret of Mercury in a solution of pure Potassa, the excess of Sulphur is converted into Sulphuret of Potassa, and thus removed from the Sulphuret of Mercury, which remains in the form of a black powder, insoluble in nitric acid; and, when exposed to a red heat, it assumes all the characters of the Red Sulphuret, or Cinnabar. Now, as Cinnabar requires for its formation two proportionals of Sulphur and one of Mercury, the conversion of the black powder, remaining after the action of the Potassa, into Cinnabar, when exposed to a red heat, authorizes the conclusion that the Mercury in this preparation exists also as a Bisulphuret. Mr. Brande regards the Black Sulphuret as a compound of

Bisulphuret of Mercury	58	or 1 equiv. =	234.2
Sulphur	42	— 1 —— =	16.1
	100	Equiv.	250.3

This is the opinion of Mr. Brande: but Mr. Phillips regards it as a mixture of

1 equiv. of Mercury =	202.
1 —— Sulphur =	16.1
	218.1

When heated in an open vessel, it emits sulphurous acid gas, becomes of a deep violet hue, and afterwards sublimes of a brilliant red colour.

This is very inactive and uncertain as a therapeutical agent. It is chiefly used as an Excitant to reduce scrofulous swellings; and sometimes in diseases of the skin, and for destroying ascarides. The dose is from gr. v to ʒss.

b. Bisulphuret of Mercury. *Hydrargyri Bisulphuretum.* L. *Hydrargyri Sulphuretum Rubrum.* E. This second preparation of Sulphur with Mercury, in which heat is employed, is the Red Sulphuret, the *Minium* and *Cinnabar* of the ancients*; the *Vermilion* of the moderns. It is found native in Adria, Almaden, and in South America, both in the massive and the crystallized state. It is prepared by bringing 32 parts of Mercury into contact with 5 parts of Sulphur in a melted state, and afterwards rubbing the compound into powder, and subliming. It is more simply prepared by subliming the Black Sulphuret prepared by trituration.

This preparation may be regarded as a Bisulphuret, in which the combination of the Sulphur and Mercury is more complete

* Theophrastus informs us that Cinnabar was accidently discovered by Callius, who lived 494 years before Christ. Gieger found it in the colouring of old Egyptian tombs.

than in the Black Sulphuret. It is in the form of dark-red crystalline cakes; permanent in the air; inodorous and insipid; which assume a bright scarlet hue when powdered; are insoluble in water, and not acted on by sulphuric or hydrochloric acids. Chlorine inflames this sulphuret: and a mixture of nitric and hydrochloric acid decomposes it and separates the sulphur. It is decomposed in a red heat; the sulphur being converted into sulphurous acid and flying off, and the Mercury evaporating in fumes: it is also decomposed by lime, the alkalies, and several of the metals, aided by heat. It consists of

Mercury .	86.32	or 1 equiv.	= 202.
Sulphur .	13.68	— 2 —— (16.1×2)	= 32.2
	100.00		Equiv. 234.2

Cinnabar is sometimes adulterated with Minium or red lead: but it is easily detected by boiling the Cinnabar with acetic acid, and testing the solution with Hydrosulphuric acid, which will blacken it if Minium be present; or with Iodide of Potassium, which will precipitate yellow Iodide of Lead. If we suspect Realgar in it, it should be boiled in liquor potassæ, and the solution saturated to excess with nitric acid:—the hydrosulph. acid will give a yellow precipitate if Realgar be present. As a remedial agent in venereal affections, it has been used in the form of fumigation; but it is inferior to the grey oxide for this purpose, and hazardous from the sulphurous acid evolved. It is altogether a very inert and unnecessary preparation, and is now rarely employed, except in some empirical nostrums, in which Dr. Paris assures us that it forms the chief ingredient.

* * *Mercury with Iodine.*

The combinations of Mercury with Iodine are formed either by triturating the Mercury and Iodine together, and afterwards subliming the mixture in a tube, or by decomposition.

IODIDE OF MERCURY. *Hydrargyri Iodidum.* L.—In the London Pharmacopœia, this Iodide is ordered to be prepared by rubbing together, with the addition of a little alcohol, an ounce of Mercury and five drachms of Iodine, until globules are no longer visible. After which, the powder is to be dried with a gentle heat, and preserved in a well-stopped bottle, excluded from the light. In this state, it is a greenish yellow powder, insoluble in water, unless combined with Iodide of Potassium; and insoluble in alcohol, but soluble in ether. It is readily decomposed by heat. When fused, it sublimes, unaltered, in red scales, which become bright lemon-yellow by cooling, and are not decomposed by light so readily as the unsublimed powder. It is a compound of 1 equiv. of Mercury

= 202, + 1 equiv. of Iodine = 126.3, equiv. = 328.3; or Hy. + I.: or 61.6 parts of Mercury, + 38.4 of Iodine, = 100.00.

This preparation may also be readily produced by adding a solution of the protonitrate of Mercury to a solution of the Iodide of potassium. In this case, the nitric acid of the nitrate employed combines with the potassa, formed by the union of the Oxygen of the Oxide of mercury in the Nitrate with the Potassium of the Iodide, forming nitrate of potassa; thus setting free the Iodine as well as the metallic mercury, which, instantly combining, produce the iodide.

Iodide of Mercury operates as an excitant, displaying its influence, chiefly upon the capillary system, more rapidly than Mercury; but not accumulating in the system to the same extent as Mercurials, the Mercury passing freely off by the cutaneous exhalants in conjunction with the Iodine. It is employed, both topically and generally, in syphilitic and strumous affections.

For the facility of internal administration, the London College orders a pill* composed of ℈i of the Iodide and ℈i of powdered Ginger, and ℈iii of the Confection of Hops. One grain of the Iodide is contained in five grains of the pill. The London College, also, orders an ointment† to be made: ℥i of this Iodide, ℥ii of white Wax, and ℥iv of Lard. It forms a useful stimulant dressing for scrofulous ulcers, lupus, and some other affections of the skin. In no form is the Iodide so frequently employed as that of Biniodide of Mercury.

Biniodide of Mercury. *Hydrargyri Biniodidum.* L. E. This Iodide is prepared, according to the London Pharmacopœia, in the same manner as the Iodide, using ten drachms, or double the quantity of the Iodine, and one ounce of Mercury. Like the Iodide, when fused, which it does at 400°, it sublimes unchanged, and crystallizes in brilliant, yellow, rhombic scales, which become of a beautiful vermilion colour as they cool.

Both these Iodides are more readily and better prepared by precipitating some of the soluble salts of Mercury by a solution of Iodide of Potassium. The Protonitrate may be used for obtaining the Iodide, and either the Pernitrate or the Bichloride for the Biniodide. When the Nitrates are employed, the Potassium is oxidized at the expense of the Oxide of the Nitrate of Mercury, and a Nitrate of Potassa remains in solution, whilst an Iodide of Mercury is precipitated. When the Bichloride is used, the result depends upon a simple transference of components; a Chloride of Potassium and a Biniodide of Mercury are formed. Two hundred and seventy-four grains of the Bichlo-

* Pilula Hydrargyri Iodidi, L.—dose gr. v.

† Unguentum Hydrargyri Iodidi, L.

ride of Mercury in solution decompose 332 of the Iodide of Potassium. The precipitate, when washed and dried, may be sublimed.

This Biniodide is of a bright vermilion colour, insoluble in water, and only partially soluble in cold alcohol. When dissolved in boiling alcohol, it is deposited in rhombic prisms as the solution cools; and the same result follows from dissolving it in a hot solution of Pernitrate of Mercury. It is rendered soluble in water by means of Iodide of Potassium or Chloride of Sodium: but if a concentrated solution of the Iodide of Potassium be used, a double salt, a hydrargyro-Iodide of Potassium, is formed. This Biniodide is a compound of 1 eq. of Mercury, = 202, + 2 eq. of Iodine, = 252.6, equiv. = 454.6, or of 44.5 of Mercury, + 55.5 of Iodine, = 100.0. Its physiological influence on the habit is similar to that of the Iodide; but it appears to be more rapidly taken into the circulation, and resembles in its action the Bichloride. Topically applied, it produces a rubefacient effect: and, in the proportion of two grains to ʒi of Cetaceous ointment, it has been found useful in opacity of the Cornea*, and in Ophthalmia Tarsi, with thickening of the meibomian glands. Internally administered, in doses of one sixth to one fourth of a grain, I have found it useful in Lepra, and other dry affections of the skin, when an alterative is required.

The London College orders an ointment of the Biniodide composed of one part of the salt, two of white wax, and six of lard. It is a useful dressing to scrofulous sores.

Both these compounds of Iodine are insoluble in water, unless the fluid hold in solution a portion of Iodide of Potassium. The Protiodide has a sp. gr. 7.75, the Biniodide 6.32: when heated with potassa, both are decomposed and resolved into Iodide of Potassium and metallic Mercury. The Biniodide, besides being soluble in the solution of the Iodide of Potassium, is soluble in Nitric acid and some other acids, in pure Potassa, Chloride of Sodium, and Alcohol. When dissolved in boiling alcohol, it is deposited, on cooling, in the form of right rhombic prisms.

The dose of the Biniodide of mercury should not at first exceed a sixth, or a fourth of a grain, which may be given in the form of a pill, night and morning: but sometimes, even in these doses, it causes an uncomfortable sensation of heat at the epigastrium, loss of appetite, and restlessness; under which circumstances, its use should be suspended for some days.

For external application, the ointments already mentioned are prescribed†.

* Graefe and Walther's Journ. of Chir. Bot. 13; quoted by Pariera.

† Unguentum Hydrarygri Iodidi. L. Unguentum Hydrarygri Biniodidi. L.

* * * *Mercury with Cyanogen.*

Mercury readily combines with CYANOGEN, which is a compound substance, consisting of carbon and nitrogen in intimate union. (See Sedatives).

BICYANIDE OR CYANURET OF MERCURY—*Hydrargyri Bycyanidum*, L. *Hydrargyri Cyanuretum*, D.—is formed by boiling one part of Binoxide of Mercury with two parts of Prussian blue in seven or eight parts of water; the mixture gradually loses its colour: a double decomposition takes place; the Oxygen of the Binoxide unites partly with the Iron and partly with the Hydrogen of the Ferrocyanic acid; two equivalents of the Cyanogen, set free, unite with the Mercury, and produce the Bicyanide, which remains in solution; while peroxide of iron is precipitated.

Bicyanide of Mercury is perfectly neutral, colourless, inodorous, with a styptic, disagreeable taste. Its crystals are quadrangular prisms, having a sp. gr. 2.7612. They are soluble in water, but more so in hot than in cold water: boiling water deposites again the salt on cooling. The solution is decomposed by sulphuretted hydrogen gas; and sulphuret of mercury is precipitated, whilst hydrocyanic acid remains in solution. The salt is, also, decomposed by heat; its colour changes to a deep brown, metallic Mercury is sublimed in the vessel, and Cyanogen* escapes in the gaseous state.

Bicyanide of Mercury is composed of 7.91 parts of Mercury, + 20.009 of Cyanogen; or 1 eq. of Mercury, = 202, + 2 eq. of Cyanogen (26.39×2) = 52.78; equiv. 254.78.

This preparation, now ordered in the British Pharmacopœias, is employed on the Continent as a remedy in syphilis, and in suppression of urine†. From gr. xii to gr. xxiv are dissolved in two pints of distilled water; and from one spoonful to four spoonfuls, in a glassful of mucilage of gum, are given twice a day. It is also prescribed in pills containing from one eighth to one sixth of a grain; but it requires to be administered with great caution. It operates as a virulent poison when given in large doses, producing effects closely resembling those caused by corrosive sublimate.

* Cyanogen, in the form of gas, is colourless; has a peculiar odour: it cannot support combustion, but is inflammable and burns with a violet-coloured flame. 100 cubic inches weigh 55.3 grains. Its composition is 2 Carbon, = 12.24, + 1 Nitrogen, = 14.15, equiv. 26.39.

† Archives Générales de Medecine, vol. ix. Dic. des Scien. Med. t. xxxii, p. 480. Stucke de Alcaloidibus. Berlin, 1822.

* * * * *Mercury with Chlorine.*

Mercury has a powerful affinity for Chlorine; and, by uniting with it, produces salts which are the most active medicinal agents among the preparations of this metal. If Mercury be poured into a phial containing chlorine gas, and agitated, the fluidity of the metal is instantly destroyed, and the phial becomes coated as if it contained an amalgam of Mercury; by continuing the agitation for a sufficient length of time, a protochloride of Mercury is formed. When heat is called in to aid the union of the Mercury and the chlorine, the union is more immediate, the Mercury is volatilized, takes fire, and a bichloride is formed.

Chloride of Mercury, Calomel—*Hydrargyri Chloridum*, L. *Calomelas*, E. *Calomelas sublimatum*, D.—is prepared either by sublimation or by precipitation.

* *By sublimation.*—If four parts of the Bichloride of Mercury be triturated with three parts of fluid Mercury, a decomposition of the bichloride takes place; a portion of the chlorine passes to the Mercury, and the whole is converted into the Chloride. This conversion, however, is imperfect; therefore the mixture must be sublimed to complete it. In the London process, four pounds of Mercury, three pounds of sulphuric acid, and a pound and a half of Chloride of Sodium, are the ingredients employed. A bipersulphate is first formed by boiling together two pounds of the Mercury with the whole of the sulphuric acid to dryness; then rubbing this bipersulphate, when cold, with the remainder of the Mercury, and adding the Chloride of Sodium, until all globules disappear, and lastly subliming. In this process, when the Mercury is combined with the Bipersulphate, a Protosulphate results; and when this is sublimed with the salt, a double exchange takes place; the oxygen of the oxide of Mercury in the Protosulphate is attracted by the Sodium of the common salt, which is thus converted into Soda, and, attaching itself to the Sulphuric acid of the Protosulphate, forms Sulphate of Soda, whilst the Chlorine of the common salt unites with the freed Mercury and forms the Chloride or Calomel. It is then to be reduced to powder and to be washed with boiling distilled water The propriety of using boiling water may be doubted, as the Calomel is apt to be reduced by it and converted into metallic Mercury and Bichloride of Mercury. Mr. Hennell, of Apothecaries' Hall, supposes that this takes place even at ordinary temperatures. The Edinburgh process is nearly the same as the London.

It was formerly thought that many sublimations were necessary to form good Calomel; Lemery ordered three sublimations;

but, not satisfied with this, it was frequently sublimed seven times, and was then termed *Aquila alba*. In this respect, however, the object is defeated by the sublimations; each giving rise to a fresh formation of bichloride: yet, so late as 1760, Professor Alton says, "The oftener it is sublimed, the less it purges, the more easily it enters the lacteals, and so the sooner and more certainly it raises a salivation!"

Much depends, indeed, even in appearance of the preparation by the mode of subliming it. In small vessels, it forms a crystalline cake; in large, kept very cold, a soft white powder, without lustre.

Calomel in its crystalline form is a right square prism. Its sp. gr. is 7.176. As usually found in the shops, it is of a pale ivory colour, which indicates its purity, at least the absence of the bichloride. It is inodorous and nearly insipid. Its sp. gr. is 7.2. It is insoluble in water and in alcohol.

* * *By precipitation.*—The Dublin College orders the protochloride to be also prepared by precipitating the protonitrate of Mercury with a solution of Sea-salt. A double decomposition takes place. The Chloride of Sodium is decomposed, and the Sodium, being oxidized, is first converted into soda, and then into nitrate of soda, by combining with the nitric acid of the protonitrate; whilst the Chlorine, set free, attaching itself to the Mercury, freed from its oxygen and nitric acid, forms the Chloride. There are many objections to this preparation. In the first place, no heat, although directed in the Pharmacopœias, should be employed in any part of the process: in the second place, a much larger quantity of water than is ordered should be employed, to prevent the reaction of the hydrochloric and nitric acids and the consequent formation of Chlorine, which, by combining with a portion of the Chloride, converts it into the Bichloride: in the third place, it is almost impossible to obtain this Calomel wholly free from the Protonitrate of Mercury, the acrimony of which causes purging and griping; and, therefore, well-prepared Sublimed Calomel is to be preferred to this precipitated Chloride.

The Chloride of Mercury requires 1152 parts of boiling water for its solution. It differs from the Bichloride in the following particulars: when rubbed in a mortar with caustic potassa, it is changed into black Protoxide of Mercury, owing to the alkali appropriating the Chlorine, changed by the partial decomposition of the water of its solution into hydrochloric acid: the Bichloride by the same process forms a brick-red precipitate. It is changed by solution in nitric acid, and in the aqueous solution of Chlorine, which converts it into the Bichloride. Lime-water decomposes the Chloride, in whatever manner prepared, and forms it into the state of the black oxide: and this is an ex-

cellent test of its purity; for, if it contain any of the bichloride, an orange-red tint is mixed with the black on the addition of lime-water. The alkalies and their carbonates, solution of sulphuretted hydrogen, the hydrosulphurets, solution of soap, and several of the metals, antimony, iron, lead, copper, and their salts, also decompose the Chloride of Mercury. When rubbed with Protochloride of Tin, the Calomel is reduced to metallic Mercury, and the salt of Tin converted into a Bichloride. It is partially decomposed by long exposure to light.

The composition of this salt is

Chlorine . . .	15.12	or 1 eq. =	35.45
Mercury . . .	84.88	1 eq. =	202.00
	100.00	Equiv. =	237.45

This is one of the most useful of the mercurial preparations*. There is, indeed, scarcely any class of diseases for the relief of which it is not more or less employed.

Calomel operates on the living body as a mild excitant, augmenting the general secreting function, but more especially that of the liver, the pancreas, and that of the mucous membrane of the intestinal canal. By continuing its use, the constitutional symptoms caused by mercurials result; namely, fever and salivation.

It has been asserted that, when Calomel is taken into the stomach, it is always partly converted into the Bichloride, and thence becomes active: but this view of its influence requires to be authenticated by further observations. In doses of ten and twelve grains, it acts as a sedative in an irritable state of the stomach: but in larger doses it is said to have proved poisonous, and cases of its poisonous effects are recorded; but I have never witnessed any to follow the largest doses.

It is curious to observe the extraordinary revolutions which has taken place, at various periods, with regard to the doses of this preparation. The ordinary dose, at present, when we are desirous of bringing the system under the mercurial influence, is from one grain to two grains, combined with opium, taken every night, or every morning and evening, or, at the utmost, three times in twenty-four hours, until the gums be affected.

* The inventor of Calomel is not known: but the process for preparing it was made public by Beguin, in 1608. It has been known by a variety of names: for example, Draco mitigatus, Sublimatum dulce, Aquila alba and mitigata, Manna metallorum, Panchymagogum minerale, Panacea Mercurialis, and several other appellations. The term Calomel, from καλὸς and μέλας, although it is more applicable to a black powder than to one of an ivory colour, yet it is a better name, and more effectually prevents this preparation from being confounded with the bichloride, than the appellation Chloride, adopted by the London College. A natural chloride occurs crystallized in quadrangular prisms terminated by pyramids. It is called *Horn Quicksilver*.

Schreder states that, in his time, the dose was half a drachm: Geoffrey makes it from six grains to thirty: Neuterus gave, at first, fifteen grains; for the second dose, a scruple; for the third, half a drachm; and for the fourth, a scruple; which he continued until salivation was induced: and Michaelis Albertus informs us that Helwichius gave five scruples for a dose to two patients, and seventy-two grains to a third, which affected the mouth for a fortnight. Even when it was not intended to affect the mouth, scruple and half-drachm doses were very common in the seventeenth century; and at this day, in India, scruple doses are usually prescribed in the bilious remittents of that climate.

When exhibited as an alterative, Calomel operates on nearly the same principles as the bichloride. In all chronic diseases, it is advantageously combined with antimonials and opium; but, when it is intended merely to improve the hepatic secretion, it acts better when administered alone, at bed-time, and a mild aperient taken in the morning. In the hepatic derangements of warm climates, in particular, Calomel produces the most beneficial effects; for, in general, no sooner does the presence of the Mercurial in the system manifest itself by its influence on the mouth, than the secretion of the bile assumes its proper and healthy aspect. It is, however, necessary to be aware that no Mercurial should be administered in acute inflammatory affections of the liver, until depletion has brought down the pulse; but, when this has been effected, it should be given in such large doses as will rapidly produce ptyalism. When abscess occurs, the Chloride is injurious.

In the fevers of warm climates, Calomel is given in doses of from eight to ten grains every three hours; but, even in such doses, it does not act powerfully on the salivary glands; nor is this required, as salivation would lower the system too much, and produce a very dangerous state of exhaustion. In the typhoid fevers of this country, a mild action on the mouth, from Mercurial remedies, is generally the first indication of the safety of the patient. It proves most useful when the tongue is much coated, the mouth clammy, and the stools dark and offensive. In *remittent* fevers it is less to be recommended than in either intermittents or continued fevers: indeed, we have rarely seen it supersede the febrile action in remittents. In hectic it proves injurious.

During the administration of Calomel in hepatic derangements, it frequently happens that the secretions apparently become worse, instead of better; the stools looking green, slimy, and either have no odour, or are extremely fœtid. I have, indeed, more than once, seen Calomel produce clay-coloured stools. It would be in vain to look for healthy evacuations, as prognosticating an improved state of the secretions, in such cases; but

this is no proof that a beneficial effect has not been produced by the remedy. It is, however, necessary to intermit its use for a few days, in order to ascertain the real state of the alvine ejectments, which show their natural character as soon as the intestines cease to be irritated, by the primary action of the remedy on the biliary and pancreatic ducts, bringing large quantities of badly concocted bile and pancreatic juice into the intestines. In this condition of the habit, much advantage may also be derived from diminishing the dose of the Calomel. It, nevertheless, often happens that small doses of Calomel cannot be retained on the stomach when this viscus is in an irritable state; although it retains larger doses, which then act as a sedative. My own experience has afforded me numerous illustrations of this remark; and my observations have been confirmed by a high authority on this subject, Mr. Annesley, as far as regards the employment of Calomel in India. "In large doses," says Mr. Annesley, "Calomel combines with and renders fluid and detaches the viscid mucous secretions attached to the alimentary canal: it diminishes the vascular state of the stomach when this is in excess, and increases the capillary circulation in the mucous coat of the larger intestines. Thence it is useful, in large doses, in increased vascular action of the intestinal canal, indicated by the state of the tongue and the irritability of the stomach, such as occurs in fever, hepatitis, dysentery, and peritoneal inflammation after a full bleeding*." In the dysentery of the Carnatic, when much irritability of the stomach exists, it is given in doses of a scruple every night; and this is followed by an oleaginous purgative in the morning as long as the pain continues. It acts most beneficially when the secretions are improved without any specific action being induced on the salivary glands; and, therefore, the purgative in the morning is requisite on this account. Mr. Griffin proved, also, the sedative influence of large doses of Calomel, administered before the collapse†, in 1448 cases of Asiatic Cholera.

No remedy proves so decidedly useful as Calomel in combination with Opium, administered after bleeding and purging, in croup. In the modified form of this disease, also, when it assumes somewhat of the aspect of Angina *maligna*, the pharynx and fauces being covered with grey, sloughy ulcers, Calomel, in full doses, is the only resource to be depended upon. In pneumonia, Dr. Hamilton, of Lynn Regis, a practitioner of great judgment and experience, after bleeding and purging, gave Calomel, in doses of from gr. i to gr. v, combined with gr. ¼ to gr. i of opium, every six or eight hours, until the mouth became touched; diluting freely with bland liquids in the intervals:

* Annesley's Sketches of Diseases in India.
† Lon. Med. Gazette, v. xxi, p. 880.

and in few hands have inflammations of the lungs been more successfully treated. Dr. J. Clark, in his work on the Diseases of Long Voyages, recommends this form of Mercury strongly in the intermittents of warm climates, when there is great irritability of the stomach, attended with vomiting of bile: and this practice is supported by the authority of Mr. Annesley, who recommends a scruple of Calomel and two grains of opium in such cases. He combines the Calomel with the opium; and in this form it increases the tonic power of the bark, when the use of that medicine is indicated. In the intermittents of our own climate, I have seen the bark and also the sulphate of Quina given, without any benefit, for several successive days; and yet, immediately afterwards, they cured the disease when Calomel and opium were administered at bed-time. Calomel is still most useful when ague is complicated with hepatic affections. It is given in doses of ℈i for several successive nights, each dose being followed by a purgative in the morning, as a prelude to the use of cinchona bark and its salts, in the intermittent of India; and continued, pari passu, with the bark, in small doses, until the tongue become clean*.

The dose of Calomel necessarily varies with the intention of its administration. As an *alterative*, the dose is gr. ½ to gr. i, at intervals of from eight to twenty-four hours: as a *sedative*, gr. x to ℈i: and as a topical stimulant to the duodenum, preparatory to a purgative, from gr. iii to gr. v, made into a pill with crumb of bread. As a topical application, in Lepra and dry scaly diseases of the skin, I am in the constant habit of ordering an ointment made with ʒi of Calomel, ʒiv of Tar ointment, and ℥i of Lard: and no local remedy is followed by such decided benefit.

The British Colleges order a compound pill of Calomel to be prepared—*Pilulæ Hydrargyri Chloridi compositæ*, L. *Pilulæ Calomelanos compositæ*, E. D.—the old Plummer's pill of former Pharmacopœias. The London College orders it to be made with ʒii of Calomel, ʒii of Oxysulphuret of Antimony, ʒiv of powdered Guaiacum, and ʒii of Treacle. It is employed as an alterative in chronic hepatic affections, secondary syphilis, and in some diseases of the skin. The dose is from gr. v to gr. x, night and morning.

Bichloride of Mercury. *Hydrargyri Bichloridum*. L. *Sublimatus Corrosivus*. E. *Hydrargyri Murias corrosivus*. D. —It is prepared by boiling together two pounds of Mercury and three pounds of Sulphuric acid to form the Bipersulphate of Mercury, and then adding a pound and a half of dried Chloride of Sodium, and subliming with a gradually raised heat. The theory of this process is thus explained: the metallic

* *Wedel*, Diss. de Mercurio dulci, Jena, 1700. *Lysons*, on the Action of Calomel, &c. Bath, 1772.

base of the Chloride of Sodium, the *Sodium*, is oxidized at the expense of the Binoxide of Mercury contained in the Bipersulphate, and is thus converted into soda, which unites with the sulphuric acid of the bipersulphate, and forms Sulphate of Soda: this remains in the bottom of the subliming pot, whilst the Chlorine and the Mercury, at the same instant, combine and are *sublimed* in the form of Bichloride. The perfection of the process depends on the preparation of the Bipersulphate; for, unless this be complete, a mixed salt, containing both the Chloride and Bichloride, is the result: the process, therefore, of the Edinburgh and the Dublin Colleges, into which nitric acid enters and secures the conversion of the Mercury into a binoxide, is to be preferred.

The period when this salt was first made is unknown; it is mentioned in the works of Rhases, Avicenna, and Geber, who lived in the tenth and eleventh centuries. The processes recommended in the British Pharmacopœias are a modification of the process employed by Kunkel, in 1722. In the large way, the bipersulphate and the sea-salt are ground together with black oxide of manganese, and the mixture, after being left for two or three days and dried with a gentle heat, is sublimed in bolt heads, on a sand bath. It is thus procured in the form of a solid cake. It is readily prepared by bringing Mercury, raised to a state of vapour by heat, into contact with Chlorine: an instantaneous union takes place, and the Bichloride is formed in the state of soft snowy-looking flakes*.

Another simple and direct method is to dissolve the red oxide in hydrochloric acid†. The solution is effected without any ebullition or disengagement of gas; and when it is left at rest, the salt crystallizes spontaneously. Bichloride of Mercury is usually in the form of a white semi-transparent mass, consisting of small prismatic crystals: but, when the aqueous solution is carefully evaporated, it forms in rhomboidal cubes, or quadrangular prisms, with their sides alternately narrower, terminated by dihedral summits. It slightly effloresces in the air. Its taste is extremely acrid, metallic, and most disagreeably styptic. Its sp. gr. is 5.2 at 60° Faht. It is soluble in about thrice its weight of boiling water: alcohol, at the ordinary temperature of the atmosphere, dissolves $\frac{3}{4}$ of its weight. It is very soluble in sulphuric, nitric, and hydrochloric acids, without alteration: and, in Ether and Alcohol, Camphor augments its solubility—a great practical advantage. Light decomposes the solution of the Bichloride in water, and the Chloride is precipitated. It is decomposed by the fixed alkalies

* The author has a patent for preparing by this method.
† Tromsdorff, Berthollet.

and lime-water, and an orange-coloured Hydrated Binoxide of Mercury is precipitated. Solution of arsenic does not decompose it; but the arsenite of potassa, as well as the potassio-tartrate of antimony, and the nitrate of silver, decompose it. Iodide of Potassium suffers with it a double decomposition, and Biniodide of Mercury and Chloride of Potassium are formed. The fixed and volatile oils, the resins, all vegetable infusions and decoctions containing gum, sugar, extractive, the bitter principle, tannic acid, milk, and gelatine, reduce it to the state of a Chloride: it cannot be long preserved in distilled waters or weak spirits, Calomel and Hydrochloric acid being always formed. Acetate and diacetate of lead, sulphuret of potassa, all the hydro-sulphurets, and soaps, also decompose it. Protochloride of Tin reduces it to metallic Mercury, and the salt or tin becomes a Bichloride. Ferrocyanide of Potassium changes it into Ferro-cyanide of Mercury.; and Ammonia forms with it an insoluble Ammonio-chloride of Mercury, and a soluble Hydrochlorate. These substances cannot, therefore, be prescribed in conjunction with Bichloride of Mercury. It is a compound of

Chlorine	. 26.48	or 2 eq.	$(35.42 + 2) =$	70.84
Mercury	. 73.52	— 1 eq.	——— $=$	202.0
	100.00		Equivalent $=$	272.84 (Hy. + 2Cl.)

The London College orders a solution of the Bichloride to be made with ten grains of the salt, ten grains of the Hydrochlorate of Ammonia, and a pint of distilled water: but, for the reasons above stated, it is a bad preparation: f℥i of the solution contains half a grain of the Bichloride.

Bichloride of Mercury is a most powerful Excitant. Unless it be given in very minute doses, and in solution, it causes excruciating pain in swallowing, nausea, and vomiting: quickly destroying the vitality of the stomach, and corroding it; exciting inflammation of the lungs, the heart, and the salivary glands, with oppression of the brain and nervous system. In doses barely sufficient to cause these effects, it sets up gastro-enteritic inflammation, in the first instance; and afterwards operates on the nervous centres, causing stupor, coma; convulsive twitchings of the face and the limbs; and in some instances paraplegia. These symptoms are followed by mercurial erethysm; displayed by profuse salivation, great irritation of the urinary passages, with a small, frequent, intermittent pulse, difficult respiration, cold extremities, and excessive debility which terminates in death. Post-mortem examination of the body demonstrates the living membrane of the heart to be inflamed, as well as the mucous coat of the alimentary canal. Its vapour is highly dangerous to those who breathe it. In small doses, however, it is a valuable Excitant in secondary venereal affections, and in many

cutaneous diseases, particularly lepra and other dry scaly eruptions.

Whether this preparation enters the circulation, or, as Sir B. Brodie has maintained, acts solely through the medium of the nerves, is undetermined: it has not been detected either in the solids or fluids of the body; but it is possible that it may, nevertheless, pass into the circulation; for every one conversant with chemical investigations, in reference to the detection of medicinal agents in the blood and secretions, must be aware of the extreme difficulty of detecting them, even when they have been injected into the blood. One fact noticed by Sir B. Brodie affords some reason for thinking that it is absorbed; namely, its effects are not altered by the division of the eighth pair of nerves; which would be the case did it act solely through the nerves. When it has been taken in an overdose, the best antidote is albumen; and this appears to depend on a circumstance suggested by Dr. Christison, "that compounds, formed by corrosive sublimate with animal and vegetable substances, are either not poisonous, or, at least, very much inferior in activity to corrosive sublimate itself." It is, however, a curious fact, and one which renders albumen a less useful antidote than might be expected, that, in excess, it does not effectually clothe the irritant influence of the poison; for the precipitate is redissolved. The gluten of wheat, milk, iron filings, and meconic acid, are, also, regarded as antidotes in poisoning by corrosive sublimate.

As a remedy, Bichloride of Mercury has, occasionally, been a favourite with the leading physicians of different periods. Thus it was highly prized by Boerhaave, Van Sweiten, and their followers; and on their authority it came to be very generally used in syphilis. In the secondary form of the disease, it is undoubtedly useful; the pains, nodes, and eruptions disappear under its employment. In irritable conditions of the habit, Opium and extract of Conii are useful adjuncts to the Bichloride. It should be administered in minute doses, not more than one twentieth of a grain, frequently repeated. A gargle made with gr. ii, dissolved in f℥iv of a mixture of bitter almonds, is admirably fitted for healing the ulcers of the tonsils. In cutaneous affections it is an excellent remedy, both taken internally and applied externally, when largely diluted. The dose should not, at first, exceed the thirtieth of a grain: but it may be gradually augmented to one sixth. Mr. Guthrie has lately proposed to employ it in chronic inflammation of the eyes, in the form of an ointment composed of iii or iv scruples of the bichloride, m. xv of the solution of subacetate of lead, and ℥i of cetaceous ointment. As, in this case, the salt of lead reduces the Bichloride to the state of a Chloride, the latter might therefore be used. When administered internally, it acts chiefly on the kidneys; and, on account of its acrimony, mucilaginous and demulcent drinks,

or the decoction of Sarza, should be given. The general principles upon which it affects the body are nearly the same as those of the oxides. It is employed externally in the form of lotions, injections, gargles; and, on the Continent, as baths*.

In chronic rheumatism, chronic laryngitis, mesenteric affections, and some other diseases in which inflammation of a subacute kind has been long continued, lymph is thrown out, and consequent thickening of membranes takes place. The administration of small doses of the Bichloride, in combination with antimony and opium, have been found highly serviceable when carried to an extent merely sufficient to produce slight tenderness of the gums, without exciting salivation. Very soon after the mouth is affected, the effused lymph is absorbed, and the whole of the secerning system acquires a new and more healthy action. The Bichloride, in these cases, being given in small doses, enters the circulation and stimulates generally the glandular and capillary systems, giving a new action to the whole. Thence, the further effusion of lymph being checked, that which was effused is taken up by the absorbents, and thrown out of the system. When, however, the morbid action of the capillaries, which has caused these deposits, has been sufficient to produce a change in the structure of a part, no benefit follows the use of the Bichloride, nor indeed of any alterative. The prevention of these structural changes, and the irreparable mischief to which they give rise, is the object for which the Bichloride is prescribed; and, unless they are thus anticipated, they become highly dangerous. On the same principle, the Bichloride proves beneficial in several cutaneous affections. It is given in doses of from one tenth to one fourth of a grain dissolved in alcohol or in diluted nitric acid. In a highly irritable state, however, of the system, the Bichloride, even in the smallest doses, ought not to be administered.

AMMONIO-CHLORIDE OF MERCURY. *Hydrargyri Ammonio-Chloridum.* L. *Hydrargyri Præcipitatum album.* E. *Hydrargyri submurias ammoniatum.* D.—This salt is prepared by precipitating a mixed solution of the Bichloride of Mercury and of hydrochlorate of ammonia by means of a solution of carbonate of potassa. In this operation, it is supposed that the Bichloride suffers a change by the decomposition of a portion of the water, the hydrogen of which unites with the chlorine of the Bichloride,

* See *Bromfield*, On the use of Corrosive Sublimate, &c. London, 1757. *Gataker*, Essays on Medical Subjects, &c. London, 1764. *Hoffman*, Diss. de Mer. Sub. Virtute in Affectibus Internis: Argent, 1766. *Brodie*, Phil. Trans. 1812. *Planché*, Essai sur l'Action Réciproque de quelques Sels Ammoniaceux par le Sublimé Corrosif: Paris, 1822. Manuel de l'Empoisonnent par le Deutochlorure de Mercure: Paris, 1830.

whilst the oxygen combines with the Mercury thus set free, *forming Hydrochloric acid and Binoxide of Mercury: the potassa,* also, decomposing the hydrochlorate of ammonia, the ammonia combines with the Binoxide, and shares with it the Hydrochloric acid, thus forming a triple insoluble salt, which is precipitated. It is not improbable that the carbonic acid, in this case, when a carbonate is employed, is united with the ammonia, and precipitated with it; but, as Mr. Phillips justly remarks, it is not an essential part of the compound; and the same effect is produced if pure potassa be used instead of the carbonate. The salt, thus formed, is a light, inodorous, insipid, soft, white powder, perfectly insoluble in water. Its composition is stated to be 1 eq. Binoxide of Mercury = 218.0, + 1 eq. Hydrochloric acid, = 36.45, + 1 eq. Ammonia, = 17.15; equiv. 271.60. It is sometimes adulterated with white lead or chalk, which are readily detected by exposing some of the preparation to a red heat in a spoon or crucible, when the mercurial preparation is dissipated, and the adulteration remains: this is to be dissolved in acetic acid, and solution of Iodide of Potassium added; if lead be present, a yellow precipitate will fall.

This preparation is the base of one officinal compound only, the Unguentum Hydrargyri præcipitati albi of the London College, the Unguentum Submuriatis Hydrargyri Ammoniati of the Dublin College. This ointment is a useful stimulant in itch and some other cutaneous affections, when sulphur ointment cannot readily be used on account of its smell. It may be administered internally as an alterative; but it is inferior in every respect to Calomel.

***** *Mercury with Bromine.*

Bromides of Mercury. *Hydrargyri Bromida.*— There are two Bromides of Mercury—namely, a Proto and a Bibromide. Neither is officinal in the British Pharmacopœias. The Protobromide is formed by adding the solution of the Protonitrate of Mercury to a solution of the Bromide of Potassium, an immediate precipitation of a white insoluble powder, which is this salt, takes place. The Bibromide is the result of the mutual decomposition of the Bromide and Binoxide of Mercury. It is a white crystallizable salt, fusible, volatile, and soluble both in water and in alcohol. The former of these salts resembles the Chloride, the latter the Bichloride of Mercury, both in their chemical properties and in their physiological action on the body. They have not, to my knowledge, been therapeutically employed in this country; but on the Continent they have been administered, in small doses, as alteratives. They do not possess any advantages over the other mercurial salts.

* * * * * * *Mercury with Oxygen.*

Oxygen unites with Mercury in two proportions; forming, 1. a *Protoxide,* that is, an oxide with one equivalent of oxygen; 2. a *Binoxide,* an oxide with two equivalents of oxygen.

a. Protoxide of Mercury. Hydrargyri Oxydum. L. *Hydrargyri Oxydum nigrum.* D.—When Mercury is minutely divided by friction, it is supposed to attract oxygen and to be converted into the *Protoxide.* M. Guibourt and some others have denied that Mercury, thus treated, forms a Protoxide. Many experiments tend to prove that it is merely minutely divided; and some which have been lately made by my friend Mr. Joseph Bell have almost convinced me that such is the case: but some doubt still involves this opinion. Others contend that the powder thus formed is a mixture of the deutoxide and very minutely divided Mercury. It is a black powder, without any metallic lustre, insoluble in water, and having a coppery taste; and that it is not merely mechanically divided, is rendered probable from its solubility in Hydrochloric acid, which metallic Mercury is not. According to the experiments of Donovan and Sefstrom, this black powder is a compound of

Mercury . .	96.16	or	1	equiv. =	202
Oxygen . .	3.84		1	—— =	8
	100.00			Equiv.	210

There is much probability that this statement is true: and one proof of its being an oxide, is its striking resemblance to the *grey oxide* as ordered by the Dublin College, which is prepared either by rubbing one part of Calomel in a mortar with four parts of hot solution of pure Potassa (the officinal *Hydrargyri Oxydum nigrum*), washing the product with cold water and drying it spontaneously in a dark place, or, as ordered in the London Pharmacopœia, by boiling one part of Calomel with two hundred and fifty parts of lime-water, constantly stirring and then leaving at rest until the grey oxide subsides. The precipitate is afterwards washed in distilled water, and dried in bibulous paper, without heat. In this preparation, a Chloride of Calcium and an Oxide of Mercury are formed: the lime is decomposed, and its base, uniting with the Chlorine of the Calomel, which is also decomposed, forms the Chloride of Calcium, whilst the Oxygen of the lime, combining with the Mercury, forms the grey oxide. The same explanation accounts for its formation, according to the Dublin formula; but the products are Protoxide of Mercury and of Potassium. Thence it is evident that the grey precipitate

formed from the Calomel, either by lime-water or by potassa, is an oxide: and there is reason for concluding that the grey powder produced by trituration, in as much as it resembles that thus formed from the Calomel, both in its chemical properties and its medicinal influence, is also an oxide.

This protoxide sometimes contains some unchanged Calomel. It is decomposed by light and resolved into the *binoxide* and metallic Mercury. It is insoluble in water and alkaline solutions; but it is soluble in nitric and acetic acids. Hydrochloric acid restores it to the form of Calomel by abstracting its oxygen through the medium of its own hydrogen, forming water, and then its chlorine unites with the freed Mercury. It is the supposed base of several of the most useful preparations of Mercury: but this is not the general opinion; for many contend that, in the preparations to which I allude, the Mercury is merely minutely divided.

Combined with saccharine matter, it is presumed that it forms the *Pilulæ Hydrargyri*, L. E. D. the *Blue pill*, as it is termed, which is prepared, according to the London and the Edinburgh formula, by rubbing ℥ii of pure Mercury with ℥iii of Confection of Roses, until the globules disappear, and then adding ℥i of Liquorice powder; or, according to the Dublin formula, Extract of Liquorice. Three grains of the preparation contain gr. i of Mercury. Combined with lard, it forms the *Unguenta Hydrargyri*, L. E. D. the *blue* or *mercurial ointments*, which are prepared of two degrees of strength. The strongest, *fortius*, is ordered in all the British Pharmacopœias to be made by rubbing two pounds of Mercury with an ounce of suet and twenty-three ounces of lard, until all globules disappear. Old or rancid ointment aids the process. The weaker ointment, *mitia*, of the London and the Dublin Colleges, is made by mixing one pound of the strong with two pounds of lard. The former contains half its weight of Mercury, the latter only one sixth of its weight. With the addition of camphor and ammonia, it forms the *Linimentum Hydrargyri compositum*, L. *Liniment of Mercury;* and, with ammoniacum, the *Emplastrum Ammoniaci cum Hydrargyro*, L. *plaster of Ammoniacum and Mercury*. This oxide is supposed to be the active ingredients of the preparation of Mercury with *magnesia*, *Hydrargyrum cum Magnesia*, D. which is formed by triturating two parts of Mercury with an equal quantity of Manna, until all the globules disappear, then washing out the Manna, and adding eight parts of carbonate of Magnesia. The same opinion prevails respecting the compound of *Mercury with Chalk*, *Hydrargyrum cum Creta*, L. E. made by rubbing three ounces of Mercury with five ounces of Chalk, until globules are no longer visible. The substances with which the Mercury is triturated in forming these preparations, either by their visci-

dity or some other quality, facilitate the division of the metal, and most probably its oxidizement.

BINOXIDE OF MERCURY *Hydrargyri Binoxydum.* L. *Hydrargyri Oxidum rubrum.* E. D. — This is Mercury united with a full dose of oxygen. It is effected either by exposing metallic Mercury or its protoxide to the action of heat and air, at the temperature of 600°, or by decomposing the Nitrate of Mercury by means of heat, or the Bichloride by Potassa. For preparing the *first variety*, the Dublin College orders pure Mercury to be put into a glass vessel with a long narrow neck and broad bottom, and to be exposed to a heat of 600° until the Mercury is converted into red scales. For preparing the *second*, the London College directs three pounds of pure Mercury to be dissolved in a pound and a half of nitric acid, diluted with two pints of distilled water, and the solution evaporated until a solid substance remains. This is to be rubbed to a powder and exposed in a shallow vessel to a slow fire, gradually raised until red vapours cease to appear. For the *third* process, four ounces of the Bichloride, dissolved in six pints of distilled water, are to be decomposed by twenty fluid ounces of solution of Potassa. The precipitate to be washed until every trace of alkali disappears, and, lastly, dried.

In the first mode of preparation, the Mercury is slowly volatilized: and in this state of minute division, and at 600°, the affinity between the metal and the oxygen of the air is sufficient to make the latter leave its elastic state, and, uniting with the Mercury, to constitute a new solid. In this manner, the metal attracts the oxygen of the air circulating within the vessel: and, by degrees, is converted into a binoxide. But, if the heat be increased above 600°, the oxygen is again expelled, and the oxide reduced to the state of metallic Mercury. In the second process, when the Nitrate of Mercury is exposed to an augmented heat, nitric-oxide escapes, and a mass of a bright red colour remains*. This preparation is generally supposed to be a simple binoxide, arising from the decomposition of the nitric acid; but it always retains a small portion of the nitrate undecomposed, as the degree of heat requisite to decompose the whole would be sufficient to expel the oxygen and reduce the metal. The presence of the nitrate is easily demonstrated by heating the precipitate in a glass tube; if it contain any nitrate, a yellow ring will form above the heated part. The Nitric-Oxide is of an orange-red colour; for, although its chemical components are the same as those of the Binoxide produced by the action of heat and air, yet it has neither the ruby-red colour nor the scaly appearance when it is prepared in the manner ordered

* *Hydrargyri Nitrico-Oxydum.* L. *Hydrargyri Oxydum Nitricum.* D.

in the Pharmacopœias. M. Gay-Lussac has demonstrated, that the difference observed in the grain and the colour depends on the crystalline state of the nitrate employed. If the salt be well bruised, an orange-yellow oxide, dull, and in powder, is the result; if it be in large dense crystals, the oxide will be of a deep orange colour; and, if it be in small crystalline grains, it will have a scaly or crystalline character, and an orange-red colour*. It is scarcely soluble; but it communicates its metallic taste to water, and changes syrup of violets green. It is slowly decomposed by light; and, at a temperature of 900°, the oxygen leaving the metal and escaping in the form of gas. The oxide is completely dissolved when heated in the open air.

The Binoxide prepared by precipitation is a hydrate, and, when well prepared, has an orange-yellow colour. When heated in a glass tube, it is decomposed, evolves oxygen, and is reduced to metallic Mercury. Its composition is the same as the Binoxide per se, plus one equivalent of water. Its purity is known by dissolving it in nitric acid, and testing with nitrate of silver: if any precipitate occur, some undecomposed Bichloride is present.

The Binoxide of Mercury thus prepared is either in deep ruby-red, brilliant scales, or in scarlet-colour scales, or as a bright orange-yellow powder, inodorous, and impressing an acrid, disagreeable taste on the palate. It is soluble to a small extent in water; is poisonous to animal life, causing violent vomiting and purging when taken into the stomach; and, in small doses, it is capable of quickly producing salivation. This oxide contains, as nearly as possible, double the quantity of oxygen contained in the protoxide; or of

Mercury . .	92.6	or 1 eq. =	202
Oxygen . .	7.4	— 2 eq. =	16
	100.0	Equiv.	218

The small portion of the nitrate which the Nitric-Oxide contains renders it too acrid for internal use; but it is a useful escharotic when applied externally to fungous growths, and forms an excellent stimulating ointment when combined with lard or any bland ointment. All of these varieties of Binoxide are sometimes adulterated with brick-dust and red oxide of lead. These substances are easily detected by putting any specific quantity of the suspected oxide into a thin porcelain

* M. Brugnatelli prepares it by pouring upon one part of pure Nitrate of Mercury, three parts, by weight, of boiling distilled water; a small part only of the salt dissolves, and the rest is converted into a white concrete powder; five or six parts more of boiling distilled water are then poured on this powder: it instantly acquires a bright scarlet colour, and red precipitate, requiring only to be washed on the filter and dried in a dark place, falls down.

saucer, and submitting it to a strong heat; if there be any residue, its weight will give the quantity of the adulterating substance. If oxide of lead be this substance, it may be at once detected by mixing a small portion of the suspected binoxide of Mercury with a little lard, and submitting it to the action of the blow-pipe in a hollow made on a piece of charcoal; if litharge be present, a globule of lead in the metallic state will be formed.

Such are the Oxides of Mercury. In large doses they exert a powerful poisonous influence on the body, and, even in small doses, considerable action on the animal economy, whether taken into the stomach or applied to the surface, or inhaled by the lungs in the form of vapour; in all of which modes they are employed as Excitants. They are taken into the circulation and produce a degree of temporary fever, increasing the action of the heart and arteries, elevating the animal temperature, and augmenting the irritability of the nervous system, manifested by a full, quick pulse, heat of skin, perspiration, thirst, and restlessness. After a short time, a taste of copper is perceived in the mouth; the breath acquires a strong fœtid odour; the gums swell and become spongy; the tongue enlarges; the teeth loosen; and the saliva is secreted so abundantly as to run out at the mouth. These Oxides are not much employed: their administration, after salivation has continued to a great degree, may augment the fever set up so as to affect the brain, and even to cause death. When this has taken place, post-mortem examinations have detected metallic Mercury deposited in the mesenteric glands, in the salivary and mammary glands, and even in the cancelli of the bones*. During life also, the reduced Mercury is exhaled from the surface; as its amalgamation with silver and gold, worn in the pockets of those under a mercurial course, clearly demonstrates. Now the question is, how has this reduction taken place? and whether is it the oxygen or the entire oxide of the metal that is the active agent? Although the difficulty of determining this point by any direct examination is undoubted, yet we may be conducted to a decision by collateral evidence. We know, for example, that albumen decomposes corrosive sublimate in the stomach, and reduces it to the state of calomel; it is therefore not improbable that the albumen of the blood may act in the same manner upon these oxides when they are taken into the circulation; and, during their reduction, the oxygen which they evolve may produce that state of excitement necessary for the destruction of the action which forms the venereal virus. It is not improbable also that the oxide is partly converted by the hydrochloric acid in the stomach into the bichloride. This hypothesis derives some support from the effects of

* Joan. Farnel, cap. 7, Fallopius, cap. 78, &c.

other oxidizing bodies in syphilitic affections; such, for instance, as the chlorates of gold and potassa, which cause salivation under certain circumstances. It is, however, certain, that the Oxides of Mercury, when properly applied to the skin, or when taken with due caution into the stomach, cure the venereal disease, and manifest their influence on the habit by exciting powerfully the salivary glands and their excretory ducts. They are now seldom or never ordered.

****** *Oxides of Mercury combined with Acids.*

The Oxides of Mercury unite readily with acids. The preparations formed by this union are different, according to the nature of the oxide, whether it be a protoxide or a peroxide.

a. Protoxide with Nitric Acid.—The British Pharmacopœias order one preparation in which the protoxide is combined with Nitric Acid, the ointment of the Nitrate of Mercury, *Unguentum Hydrargyri Nitratis.* L. D. *Unguentum Citrinum.* E.—The salt produced is a pernitrate; but it is partially decomposed or reduced to a protonitrate by the fat and oil combined with it. The London College has ordered this ointment to be prepared with one ounce of Mercury and eleven ounces of Nitric acid to form the nitrate, which is then to be mixed with six ounces of lard, and four fluid ounces of olive oil; but, when these proportions are adhered to, the nitrate is gradually reduced by time to the simple protoxide; and the ointment becomes so brittle as to resemble a plaster, and consequently is unfit for use, even when softened by the addition of oil. When no lard is employed, a golden-yellow ointment is the result, which is very long of acquiring an undue consistence; and it is said that this consistence is never acquired if a larger proportion of nitric acid be employed. The ointment, when well prepared, should have a fine golden-yellow colour, and a soft consistence. It is a compound of Elaidine, Elaidate of Mercury, Nitrate of Mercury, and a yellow colouring matter. Mr. Duncan, of Edinburgh, prepares a most pefect ointment, equal in colour and permanent in softness to the empirical preparation known under the name of the Golden Eye Ointment, by employing ℥xii of Nitric acid and ℥iv of Mercury to make the Nitrate, which he pours whilst hot into a hot solution of ℥xii of Lard and ℥xxvi ss of Olive oil, assisting the combination with heat if it does not froth up. The difference between this and the officinal preparations is the larger proportion of acid employed, and the higher temperature applied at the time of the mixture of the mercurial solution with the oily substances*. The Edinburgh College orders f℥viii of acid to ℥iv of Mercury, ℥xv of Lard, and f℥xxxii of Olive oil; and

* Edinburgh New Dispensatory, 12th edit. p. 1049.

the nitrate to be added hot to the fatty solution also hot. If the mixture does not froth, heat must be employed to affect it. The proportions of the Dublin College are nearly the same in reference to the nitrate, but it orders ℥iv of lard and Oi of oil. This ointment is not employed in syphilis, except as a topical Excitant in some chronic eruptions in secondary affections of that disease*. It is useful in Ophthalmia Tarsi, when diluted with olive oil.

b. With Acetic Acid.

Acetate of Mercury. *Hydrargyri Acetas.* D.—This is the proto-oxide of Mercury combined with acetic acid. The directions of the Dublin College are to dissolve nine parts of Mercury in eleven parts of diluted Nitric acid, aiding the solution, after the effervescence has ceased, by heat. To this a boiling solution of Acetate of Potassa, in 100 parts of distilled water, acidulated with acetic acid, is to be added; and the whole filtered, and left to crystallize as the solution cools. Lastly, the crystals are to be washed with cold distilled water and dried in paper with a gentle heat. In this process, the protonitrate of Mercury is first formed: and this is afterwards decomposed by the acetate of potassa; the results being nitrate of potassa, with some undecomposed nitrate of Mercury held in solution, and a Proto-acetate of Mercury, which, as the solution cools, crystallizes in silky scales. It is of importance, in preparing the protonitrate, that a *low* temperature be employed, as otherwise a peroxide is apt to be formed, and a Peracetate instead of a Proto-acetate, be the result†. The solution of the Acetate of Potassa should be boiling hot when that of the warm protonitrate of Mercury is added to it. In washing the crystals on the filter, the water should be slightly acidulated with distilled vinegar, as the Proto-acetate is extremely susceptible of decomposition. When the water is not acidulated, particularly if it be warm, a black matter, which is protoxide of Mercury, precipitates: whilst one portion only of the acetate crystallizes, leaving a deuto-acetate and free acid in the mother liquor. For the same reason, it should be dried between folds of blotting-paper, without even the gentle heat ordered by the Dublin College.

This Acetate of Mercury is in silvery, white, silky, elastic crystals, inodorous, acrid to the taste, and requiring 333 parts of water, at 60° Faht. for their solution. They are insoluble in cold alcohol; and boiling alcohol abstracts part of their acid: they are decomposed and converted into protoxide of Mercury

* Acta Nova Reg. Soc. Med. Harviensis, 1818.
† The nostrum of *Keyser* was a peracetate.

by the alkalies. When exposed to the light, this Acetate is decomposed: and this also occurs when it is heated; the metal is reduced, and vapours of acetic acid and carbonic acid are exhaled.

This salt is capable of curing syphilis; but it is rarely employed*. Its dose is from one to four grains. In overdoses, it causes a sensation of burning in the œsophagus and stomach, inflammation of the alimentary canal, vomiting and purging, sometimes of blood. The pulse is quick, full, and hard, the countenance flushed; cramps in the stomach and convulsions succeed, and, if relief be not obtained, the result is fatal.

c. Peroxide with Sulphuric Acid.

PERSULPHATE OF MERCURY. *Hydrargyri persulphas.* D.—The Dublin College orders this salt to be prepared with six parts of pure Mercury, six parts of Sulphuric acid, and one part of Nitric acid, exposed to heat in a glass vessel, and the heat gradually augmented until a dry mass is left. In this process, the nitric acid is decomposed, and gives its oxygen to the Mercury, converting it into a peroxide, which unites with the sulphuric acid. This salt is white, and contains an excess of acid, or is a Bipersulphate. It is in small prismatic crystals, from which, when boiling water is poured on it, so as to wash out a portion of the acid, it is converted into the Subsulphate. It consists of 1 eq. Peroxide of Mercury, = 218, + 2 eq. of Sulphuric acid, = 80.1, making the equivalent of the salt 298.1 (Hy. + 2 S.). It is used only for making the Subsulphate and the Bichloride of Mercury.

SUBSULPHATE OF MERCURY. *Hydrargyri Oxydum Sulphuricum.* D.—This is the *Subsulphate* (the *Turbith Mineral* of Crollius). It is formed, according to the Dublin College, by merely acting upon one part of the bisulphate with twenty parts of hot water, and washing the precipitate as long as the effused fluid forms a precipitate with liquor Potassæ. The Subsulphate has a bright lemon-yellow colour: and a sp. gr. 6.444. It is inodorous, acrid to the taste: soluble in 2000 parts of water at 60°, and 600 at 212°. It is a acompound of 1 eq. Binoxide of Mercury, = 218, + 1 eq. Sulphuric acid, = 40.1, equiv. = 258.1; or 84.5 of the Binoxide, + 15.5 of the acid, = 100.0. It is reduced by heat, sulphurous acid being evolved, and metallic Mercury sublimed. This preparation is too violent in its action to be employed as an internal remedy, and it even requires to be largely

* Cowper states that it is an ingredient in Keyser's pills. Researches on Keyser's celebrated Anti-venereal Medicine, &c. London, 1760. Robiquet has, however, ascertained that Keyser's pill contains an acetate of the binoxide. Dumas, Traité de Chimie. t. v, p. 178.

sheathed with starch or some bland powder, when it is employed as a topical Excitant, or an Errhine: as an errhine, it should be mixed with five parts of powdered starch, and not more than four grains of the mixture used at a time: as an alterative, the dose should not exceed a quarter of a grain. The preparation has been properly rejected from the Edinburgh Pharmacopœia. When it is overdosed, it operates as a powerful irritant, producing violent vomiting, purging, and inflammation of the mucous membrane; but it does not chemically corrode the animal textures. It has been used as an alterative in dry, scaly, skin diseases.

Such are the preparations of Mercury. I have purposely refrained from offering many critical remarks on the formulæ, some of which are objectionable; my object being rather to explain the theory of their composition, and their properties on the living system, than to criticise their pharmaceutical composition.

Mercury, in whatever form it is administered, and in whatever manner it is introduced into the living body, acts as an Excitant; a febrile state of the body is induced, evidenced both by the condition of the pulse and that of the nervous system; and also by an augmented secretion and excretion of the saliva. No other medicine indeed possesses, in so high a degree, the power of changing the nature of action in the capillary system. The action on the salivary glands, however, is only a symptom of this general excitement, induced by Mercurials, and not in itself essential to their curative power: it may not be produced by the administration of Mecurials, and yet syphilis may be cured by them; for the Mercurials are nevertheless taken into the circulation. "I remember," says Mr. Berry, "a young man who took Mercury for a considerable time without producing ptyalism; but, at the same time, a silver watch and money, which he had in his pocket, had become blue*." It is, also, a curious fact, which the observation of practitioners in warm climates has verified the remark, that negroes are "not so easily brought under the influence of Mercury as Indians and Europeans†."

Mercury, like every other stimulus long continued, debilitates; and, consequently, emaciation is the attendant of a Mercurial course. In producing their effects, the mercurial preparations, whether *sulphurets*, *cyanides*, *iodides*, *chlorides*, *oxides*, or *acetates*, are decomposed, and the Mercury, in a metallic form, is either thrown out of the body by the skin and the lungs, or is deposited in the glands and the bones. The

* Medical Gazette of March, 1831.

† Dr. Smith on the Diseases of Peru. Edin. Med. and Surg. Journ. vol. cxlviii, 153.

first of these facts is proved by the whitening of gold worn in the pocket of a person under the influence of Mercury; the second fact has been demonstrated by post-mortem examinations, as already noticed.

Many curious stories are related to account for the manner in which Mercury passes out of the habit. Thus, Fallopius, in his Treatise de Morbo Gallico, and some other old authors, assert that gold held in the mouths of persons salivated with Mercury has been amalgamated, and the Mercury afterwards expelled from these amalgams by heat. Fourcroy mentions a story of a gilder, who was attacked with an eruption of small cutaneous boils, in each of which a globule of quicksilver was found: M. Tourda and Dr. Cantu of Turin have published accounts of its being found in the urine; and Zellar declares that he has found it both in the urine and in the bile. These statements, however, are at variance with the experiments of M. Devergie, who could find no Mercury in the blood drawn from a man who had taken 171 mercurial pills, nor in that of another who had taken 184: neither could he detect it in the saliva of many men under courses of Mercury: nor in twenty-two wine pints of urine, in a ward of men under mercurial action. There is less doubt with respect to metallic Mercury being found in the bones. Hufeland states, in his Journal, that the pelvis of a young woman who died of syphilis, preserved in the Lubben Cabinet of Midwifery, is infiltrated with metallic Mercury. That it is decomposed and passes out of the habit in a metallic state, is sufficiently demonstrated by its exhalation from the skin.

The preparations of Mercury may be introduced into the system both internally and by external application to the cuticular surface: in both cases they are conveyed into the circulation; and, in a short time, produce the peculiar symptoms which have been described. When externally applied,—the mercurial, in the form of an ointment, is either rubbed upon the parts of the body where the skin is thin, as, for example, the insides of the thighs and arms; or it is inhaled in the vapour of fumigation; or the skin is bathed with it in the form of lotions: for internal administration, Mercurials may be prescribed either in substance or in solution.

It was formerly the custom, previous to the administration of mercurials, to reduce the system by bleeding, purging, and low diet. Perhaps this was carried too far: but, as much harm arose from the opposite custom: and, if any benefit have arisen from endeavours to cure venereal affections without the use of mercurials, it is from the revival of the former preparatory measures, within certain limits. When fever is present, the system is less susceptible of the influence of Mercury; thence the necessity of the above-mentioned prefatory measures. But

some individuals, from idiosyncracy, resist altogether its influence.

It is necessary, during a mercurial course, that the patient maintain the temperature of the surface uniform by warm clothing; both on account of aiding the action of the remedy on the glandular system, and enabling the Mercury to pass off freely by the surface. The necessity of this is well illustrated by the greater influence of Mercury in curing syphilis in warm than in cold climates. If the stomach and intestines be in an irritable condition, Mercurials are likely to increase this state; and, therefore, opium is to be combined with them. If much sweating supervene, the patient must be cautiously exposed to a cooler air; the clothing lightened; bark and acids exhibited: and the perspirations moderately checked: and this is the more necessary to be attended to if salivation is not to be produced.

Friction with the mercurial ointment is the most frequent mode of exhibiting mercurial remedies in syphilis. It is usual to begin by rubbing ʒss of the ointment on the inside of the thighs. This friction should be performed before a fire, and with some degree of force; as the wearing down of the cuticle favours the absorption of the Mercury; indeed, it is probably never absorbed until this takes place. Whether the Mercury, if it exist only in a state of minute division in the ointment, is oxidized by the friction, I cannot venture to affirm, although it is probable that it may be thus changed before it is absorbed. The quantity of ointment should be gradually increased; and its use continued until a coppery taste is felt in the mouth, the breath become fœtid, and the gums tender: after which, the friction may be employed less frequently, if these symptoms increase. On the contrary, if they do not appear in eight or ten days after the commencement of the use of the ointment, the quantity must be augmented.

A very slight degree of salivation is necessary to satisfy the practitioner that the Mercury is producing its full action on the habit; but this effect must be closely watched, for, in some persons, very small quantities of any mercurial will produce violent salivation. It sometimes proceeds so far, that ulceration and sloughing of the cheeks and fauces takes place: the gums, also, ulcerate, the teeth drop out, and necroses of the alveolar processes supervene; whilst the strength of the patient is worn down by the profusion of the salivary discharge, and the extent of the irritative fever which accompanies this condition. Under all circumstances, therefore, beyond a certain degree, salivation must be checked. Many methods have been devised to effect this object. Thus, Plenck, an excellent physician and a well-known medical author, supposed that he could effect it by dividing the Mercury by trituration in water with gum Arabic:

it has also been proposed, for this purpose, to exhibit the Mercury in the form of an amalgam with tin; but, if Mercury act upon the habit, no form of preparation that has any activity can produce its full effect without exciting some degree of salivation. It is not the salivation that is the evil, but the excess of it. The symptoms that indicate its excess are much swelling of the tongue and the inside of the cheeks, swelling and ulcerations of the tonsils, the formation of sloughing ulcers, fever, great restlessness, and a copious discharge of saliva. But, besides the plans to prevent salivation becoming profuse, means have been suggested to check it when profuse. Some of them, however, are not to be recommended, and frequently fail. Sulphur has been prescribed; but the experience of those who have had the best opportunities of judging, have not satisfied themselves that it possesses any efficacy in diminishing mercurial action. Nitre, Iodide of Potassium, Camphor, Cinchona bark, Disulphate of Quina, preparations of Iron, have been employed, to little purpose. A more effectual method of checking salivation is the administration of purgatives and opium: the former produce their beneficial effect by inducing a greater action in the intestinal system of glands, and thereby lessening the determination of blood to the salivary organs; the latter by diminishing the general irritability of the habit. But the most decided method of checking profuse salivation is the free exposure of the patient to a cool dry air. Mr. John Pearson, who first recommended this method of managing salivation, remarks that he was induced to try it from observing its excellent effects in that often fatal mercurial Erethismus which sometimes occurs when mercurials appear to act as poisons upon the system. "The good effects of the practice," he adds, "justified my expectations; for I observed that the breathing of a cool dry air was no less beneficial than pleasant to a person affected with ulcerated cheeks and gums; the animal spirits were likewise recruited; and the health so much improved, in the course of a week or ten days, that the patient was generally capable of returning to the use of his medicine again*." Besides these effects of this practice, I may add, that the abstraction also of the mind from the state of the salivary glands, by taking the patient from the monotony of his chamber and carrying him into the country, greatly aids the checking of profuse salivation, which is often kept up by excessive attention to the discharge, and from the constant attempts to eject it. The flow of saliva into the mouth is augmented, indeed, even in a state of health, by thinking of it; and this appears to depend on an increased determination of blood to the

* Pearson's Observations on the Effects of various Articles of the Materia Medica in Lues Venerea, p. 135.

part, in the same manner as in blushing; in which the flow of blood is the result of a mental stimulus on a particular set of nerves. If this explanation of the obstinacy of profuse salivation in some cases be correct, it should be an object, in attempting to check it, to divert, as much as possible, the attention of the patient from his own feelings. In checking salivation, however, by free exposure to cool dry air, much caution is necessary, that the action of the salivary glands be not too suddenly checked. " I have seen," says Mr. Pearson, " not only pains, but even general convulsions, produced from the same cause,—sudden checking the salivary discharge." This is, in fact, merely an example of that *metastasis* or translation of disease which occurs when some inflammations are suddenly checked. When it happens, the patient should be put into the hot bath, and the Mercurials again introduced as quickly as possible into the habit, until the salivation be restored in a moderate degree. With regard to the local means of checking salivation, whatever can change the action of the part, as brandy and water, a solution of Sulphate of Copper, or of Nitrate of Silver, or the liquid Chloride of Soda, will be found beneficial. As counter-irritants to divert the determination of blood from the salivary glands, blisters have proved useful. They should be applied over the affected glands.

During a mercurial course, violent diarrhœa may supervene, and be accompanied with bloody stools; or when this is not the case, the alvine discharges are whitish, sometimes green and frothy. This effect of Mercury has been ascribed to its excessive influence on the pancreas*. On the same principle, excessive action on the kidneys has caused a temporary Diabetes *insipidus*. Besides, in long-continued mercurial courses, the high state of morbid irritation is sometimes followed by an exhaustion which, too frequently, proceeds rapidly to a fatal termination. On the first appearance of any of these states, the use of the medicine must be instantly suspended, and the patients exposed freely to a cool atmosphere, with a liberal allowance of mild but nutritive diet. I have been in the habit of ordering the Disulphate of Quina, combined with the sulphuric acid, in small doses, from one to two grains every second hour, for two or three days: and I have always found it followed by the best effects.

Mercurials should be introduced into the system gradually, and in the weakest form at first. Thus, if the preparation selected be the ointment, the weak ointment should be first employed, until three or four drachms are used in each rubbing: the strong ointment is then to be resorted to in an equivalent proportion: and if, after some time, the habit appear to resist the influence

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* Dieterich. Die Merkurialrankhiet, 1837.

of the remedy in this form, it must be internally administered: if no effect be produced, Calomel may be rubbed on the inside of the gums and the cheeks; and if the habit still resist, fumigations of the grey precipitated oxide should be employed. Some physicians have recommended, in such cases, that the subsulphate, a preparation scarcely ever used except as an errhine, should be given in doses of four or five grains to excite vomiting. This practice is founded on correct physiological principles; for vomiting greatly favours that state of habit which is the result of the absorption of mercurial preparations into the circulating mass; but the remedy is too active for internal use.

During a mercurial course, although the efficacy of the remedy depends on its exciting power, yet the excitement should be moderated. The salivation should never exceed, at the utmost, two pints in twenty-four hours*; the temperature of the air in which the patient lives should not be above 75°, nor below 65° of Faht.; and the cutaneous function regularly cherished by flannel worn next the skin. The diet should be confined to milk, broths plainly cooked, mild animal food, and water or whey for drink.

In concluding these remarks on the physiological effects of Mercury, it is necessary to notice a peculiar affection sometimes induced by it in persons of a peculiarly nervous or irritable state of habit, when strongly agitated by mental impressions, and exposed to sudden alternations of heat and cold. Under these circumstances, Mercury causes a cuticular eruption of that kind which is termed *Eczema*. This affection, Eczema *Mercuriale*, was first noticed by Mr. Benjamin Bell, and afterwards investigated by Mr. Alley of Dublin, who named it *Hydrargyria;* Dr. Moriarty and Dr. Stokes, who regarded it as a species of Lepra; Dr. Spens and Mullins, who supposed it to be an erythematic eruption, and, accordingly, named it Erythema *mercuriale;* Dr. Sylvester, Dr. Willan, Dr. Duncan, jun. Dr. Kellie, Mr. Pearson, and several others. It is generally preceded by fever, dry cough, and tightness across the præcordia, and, at the same time, a diffused redness, with crowded, extremely minute vesications; and the hairs, easily detaching themselves, fall from every part of the body. The eyes and palpebræ are completely denuded, and the eyes themselves assume an inflamed aspect that gives the countenance a singular expression. The head swells, and sometimes so much as to shut the eyes altogether. The eruption extends itself from the scrotum and thighs over the whole body; and the skin, in various places, comes off in large flakes. When it proves fatal,

* Instances are recorded in which sixteen pints have been discharged in twenty-four hours. Dieterich, l. c.

the event is to be ascribed to the extreme exhaustion that accompanies the attack. No causes have been assigned for this eruption: it is not confined to any particular season or kind of weather: it attacks adults rather than the young: but no period of life is exempt from it. My own experience is at variance with the opinion that all temperaments are equally liable to this disease: on the contrary, the sanguine appear peculiarly susceptible to its attack. Sudden exposure to cold is not, of itself, sufficient to produce the disease; and I feel that I am authorized in referring it to that peculiar state of the habit termed the *hysterical**.

Many other morbid affections proceed from the improper employment of Mercurials, or from peculiarities of habit in those using it. The most frequent of these are neurotic pains, tremors of the muscular system, amounting to shaking palsy, and cachexia.

The therapeutical employment shall be afterwards noticed.

g. AMMONIA†. L. E. D. Syn. *Volatile Alkali.*

This substance is a compound of Nitrogen and Hydrogen, and is formed in every case of putrefaction of animal and vegetable matter. I am also inclined to believe that it is extensively formed in foggy weather, probably owing to a partial decomposition of the aqueous fluid in the atmosphere, the hydrogen of which, coming in contact with the nitrogen extricated from putrefying animal matter, unites with it and forms Ammonia. This theory of its formation may be questioned; but its presence in foggy weather more than at other times, is rendered obvious to the senses by its odour being strong in places where animal decompositions are in progress, during the prevalence of such weather. Ammonia is found also ready formed in nature, in combination with a variety of substances, in the neighbourhood of volcanoes; as a constituent of coal; a component of many soils; and of some of the native oxides of iron; and, in Africa, it has been found in some mineral waters. All cruciform plants yield Ammonia: it is, also, readily detected in the roots of Helleborus *niger*; Cusparia and Simaruba barks; the leaves of the Aconite, and in some other plants. In the animal kingdom, it exists, in combination, in the urine of man, and of many other animals; and most abundantly in the dung of the camel. For medicinal purposes, it is procured from the decomposition of hydrochlorate of Ammonia, Sal Ammoniac, by means of lime, which has a

* A case, highly illustrative of this opinion, is detailed in Thomson's Atlas of Delineations of Cutaneous Diseases, art. Eczema.

† So named from its being formerly obtained near the temple of Jupiter Ammon, in Africa.

stronger affinity for the acid than the Ammonia, and consequently displaces it: the Ammonia is given off in the gaseous state; but, being very soluble in water, it is combined with that fluid and forms the officinal Liquor Ammoniæ: the residue is Chloride of Calcium.

Ammoniacal gas is transparent and colourless, invisible, elastic, and possessing all the mechanical properties of common air. It has a strong pungent odour; stimulates powerfully and inflames the eyes and the nose; has an acrid, caustic taste, which it retains in its aqueous solution; and, by its effects on vegetable blues, and on litmus reddened by an acid, it proves its affinity to alkalies. Its sp. gr. is 0.5931, and 100 cubic inches weigh 18.29 grains at 50°. It cannot support combustion. Water takes up 750 times its bulk of this gas without any alteration of the properties of the gas, and the sp. gr. of the solution is 875. But, independent of water, Ammonia, under a pressure of six and a half atmospheres, at a temperature of 50°, becomes a transparent colourless fluid*. When oxygen gas and gaseous Ammonia are mixed together and exploded, water is formed and Nitrogen gas remains. Ammonia is a compound of

Hydrogen 18.37, + Nitrogen 81.13 = 100†:

or

3 eq. of Hydrogen, = 3, 1 eq. of Nitrogen, = 14.15, equiv. 17.15.

During the absorption of ammoniacal gas by water, heat is evolved: when saturated, the gravity of the solution is 0.85: in which case 100 grains of water contain 35 grains of Ammonia, or 494 volumes of the condensed gas in 1 volume of water: but the solution of Ammonia ordered by the London College, which is of the specific gravity of 0.960, consists of only 10 parts of Ammonia and 90 parts of water in 100 parts. It is in this state that it is chiefly used as a medicine.

Solution of Ammonia, *Liquor Ammoniæ*, L. *Aquæ Ammoniæ et Aqua Ammoniæ fortier*, E. *Aqua Ammoniæ causticæ*, D. is prepared, according to the formula of the London Pharmacopœia, by decomposing ten ounces of Hydrochlorate of Ammonia, by means of eight ounces of Lime, and two pints of water. The lime, slacked by a portion of the water, is put into a retort, with the Hydrochlorate broken into small pieces, and, the rest of the water being added, fifteen fluid ounces of the solution are distilled. The sp. gr. should be 0.960, and contain in 100 parts 10 parts of Ammonia: but, prepared according to the Edinburgh formula, it is 0.939, and contains 15.8 of Ammonia; according to the Dublin, 0.950, and contains 12.5 per cent.

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* Faraday.

† 100 cubic inches of Nitrogen chemically contained with 300 of Hydrogen form Ammonia.

If it becomes turbid and white when mixed with lime-water, it contains some carbonate of Ammonia: if, after neutralizing it with nitric acid, it affords a precipitate with nitrate of silver, some undecomposed hydrochlorate is present; and lime is detected if it is precipitated by oxalic acid.

The aqueous solution is colourless; has an acrid, very caustic taste, and powerful odour: displays an alkaline reaction, and, fully concentrated, should have the sp. gr. mentioned above; but this depends greatly on the pressure of the atmosphere and the temperature of the water. It is at 50° Faht. and under a pressure of 2 or 8 inches, that its sp. gr. is 0.875, and it contains 32.5 per cent. of Ammonia. It is a violent poison, whether the vapour be inhaled or the solution swallowed in a concentrated state: producing local inflammation, a rapid exhaustion of nervous energy, and death. It vesicates and corrodes the skin, when the solution is applied in its strongest state*.

Carbonate of Ammonia. *Ammoniæ Sesquicarbonatis.* L. *Ammoniæ Carbonas.* E. D.—Ammonia combines readily with the acids; and, if hydrochlorate of Ammonia and carbonate of lime be mixed in the proportions of one pound of the former to one and a half of the latter, as directed in the London Pharmacopœia, and exposed to a gradually raised red heat, a sesquisubcarbonate of Ammonia is sublimed, and chloride of Calcium remains in the subliming vessel. In this process, a double exchange takes place, the chlorine of the acid of the hydrochlorate separates from its hydrogen and combines with the calcium of the lime, the oxygen of which attaches itself to the hydrogen and forms water; thence, the Ammonia being freed from hydrochloric acid, and the carbonic acid from the lime, they unite and form the sesquicarbonate. Sesquicarbonate of Ammonia possesses the sensible properties of pure Ammonia, which it exhales; so that turmeric paper, held over it, is tinged brown. It is soluble in cold water without decomposition; but hot water decomposes it with effervescence, a circumstance which distinguishes it from the carbonate. When kept in an open bottle, the superabundant Ammonia escapes, and the salt becomes neutral and inodorous. In its perfect state, it consists of Ammonia 28.81, + Carbonic acid 55.93, + water 15.26, = 100: or Carbonic acid 3 eq. $(22.12 \times 3) = 66.36$; Ammonia 2 eq. $(17.15 \times 2) = 34.80$; water 2 eq. $(9 \times 2) = 18$, equiv. = 118.66. It is decomposed by the acids, the other pure alkalies, lime-water, chloride of calcium, magnesia, alum, bitartrate and bisulphate of potassa, bichlorides of mercury, the salts of lead, and the sulphates of iron and of zinc. These substances, therefore, should not be ordered in combination with it in prescriptions.

* The solution of Ammonia enters into several pharmaceutical preparations.

As this salt is usually found in the shops, it is nearly inodorous: this, according to Mr. Phillips, is owing to the escape of a half equivalent of the Carbonate of Ammonia in the state of gas; leaving it as a Bicarbonate of Ammonia, which is an inodorous salt.

The SOLUTION OF SESQUICARBONATE OF AMMONIÆ, *Liquor Ammoniæ Sesquicarbonatis*, L. *Ammoniæ Carbonatis Aqua*, E. is prepared with four ounces of the salt, and a pint of distilled water. It is an injudicious preparation, as it suffers a diminution of its Ammonia every time it is exposed to the air. It is administered in doses of from m. xxx to f ʒi, in any liquid which can cover its pungency and not decompose it. The dose of the solid sesquicarbonate is gr. v to a scruple, when its excitant influence is required.

The following preparations owe their properties to carbonate of Ammonia.

1. *Spiritus Ammoniæ*, L. D. a spirituous solution of the carbonate. The London College orders ten ounces of Hydrochlorate of Ammonia and sixteen ounces of Carbonate of Potassa, with three pints of rectified spirit and three pints of water, to be distilled until three pints pass over; the Dublin College orders three ounces of the sesquicarbonate of Ammonia, coarsely powdered, to be distilled with three pints of heated rectified spirit. The result of both processes is a colourless, pungent, acrid liquid. Its dose is m. xxx to fʒi in f℥iss of water.

2. *Spiritus Ammoniæ Aromaticus*. L. E. — The London College orders this spirit to be prepared with the same proportions of Hydrochlorate and Carbonate of Ammonia as the foregoing spirit; namely, 5 ounces of the former, and 2 of the latter, but with the addition of ʒii of bruised Cinnamon, ℥ii of bruised Cloves, and ℥iv of Lemon peel, with four pints of rectified spirit and four pints of water: from which six pints are distilled. The Edinburgh College prepares it by mixing f℥viii of Spirit of Ammonia, fʒiss of Oil of Rosemary, and fʒi of Oil of Lemon peel. The volatile oils of the aromatics and the lemon peel is taken up by the weak spirit; and, in this respect, it differs from the former preparation.

3. *Spiritus Ammoniæ Fœtidus*. L. E.—This is prepared in the same manner as the Spirit, with the addition of the oleo-resin or Assafœtida, of which five ounces are employed by the London College, and one ounce and a quarter to two pints of the spirit by the Dublin College; and half an ounce to f℥x of Spirit of Ammonia by the Edinburgh College. The preparation is at first colourless, but acquires a brownish colour by age. It is a useful adjunct to other medicines in spasmodic and hysterical affections. The dose is fʒss to fʒi.

As it is evident that these three preparations are mere modifications of the Carbonate, and as this, also, is not altered in its

physiological action by its union with carbonic acid, the following remaks, although the term Ammonia only is employed, yet, refers to all of them.

I have already stated that Ammonia, in its gaseous form, and also in a concentrated solution, is so powerful an excitant as to be rapidly destructive of life. The first destroys from the spasm of the glottis and consequent suffocation which it causes, as there is scarcely time sufficient for inflammation to produce its effects; the second from its corrosive influence on the mucous membrane. In its diluted state, but stronger than ordered by the Pharmacopœia, it still excites powerfully the living solid, inflaming the part to which it is applied, and causing vesication and suppuration: largely diluted, it produces a primary exciting effect on the nerves of the stomach when it is taken into that viscus, which is rapidly propagated over the system; but its effects are transitory: and thence it is regarded as a diffusible Excitant. Its use is indicated in low states of the habit in which there is a deficiency of nervous power, and in torpid states of the system, as it is said to rouse the powers of the nerves without quickening the pulse in an equal ratio. From these facts, the conclusion can only be, that Ammonia is both a topical and a general excitant; but chiefly of the nervous system.

In a practical point of view, Ammonia, in moderate doses, is employed as an Excitant in many diseases. It is peculiarly indicated in the latter stages of typhus, when petechia display themselves, and tremors and subsultus tendinum occur: it is given in combination with aromatic confection and other cordials: but it must not be given in sufficient quantity to exhaust the excitability. Although it would be highly improper to order it in the early stages of pneumonia, or at any period of that disease when active inflammation is present, yet, in the latter stages of it, when the bronchial tubes are loaded with phlegm which cannot be expectorated, Ammonia, in the gaseous state, largely diluted with common air and inhaled into the lungs, or the solution, diluted with water and taken into the stomach, promotes expectoration, and is the best mode of relieving the oppressed state of the respiration. In long-continued paralysis, which does not depend on local affection of the head, it may be used with advantage. Nevertheless, in some diseases of the head, when there is no febrile nor inflammatory symptoms present, and the vital powers require to be sustained, Ammonia and its carbonate may be advantageously prescribed. Under such circumstances, it is given in mania, in doses of from five to eight grains. In states of asphyxia and syncope, the stimulus of Ammonia is highly useful; but, in asphyxia, some caution is requisite. In dyspepsia connected with hypochondriasm, it not only proves a useful stimulus to the stomach and nervous system,

but it combines chemically with the acid which usually, in this disease, superabounds in the stomach, existing partly in the gaseous state, and thus operates, by its chemical as well as its physiological properties, in relieving this disease. In all spasmodic affections, Ammonia is perhaps one of the best stimulants that can be employed. In convulsive affections, such as asthma, hooping cough, and similar diseases, it has been regarded as exerting some specific influence; but it is to its stimulant power that its beneficial effects are to be ascribed; the spasms, in these diseases, depending altogether on that increased irritability of the system which accompanies debility. In hysteria and other nervous affections, the diffusible character of the stimulus of Ammonia renders it a medicine well adapted for such cases during the paroxysm; but it can be of very little service in the intervals, although it is often prescribed. It is not easy to explain the manner in which Ammonia operates when it is taken into the stomach for warding off the effects of the bites of poisonous snakes, unless we admit that the virus introduced into the wound acts as an immediate and direct sedative to the nervous system, and that the Ammonia, by sustaining the nervous energy, enables the system to withstand the influence of the poison until it expends its power. Triguerra* has recommended it in hydrophobia; but experience has not strengthened his recommendation. It may operate somewhat in the same manner in relieving syphilis, for which it was, not many years since, regarded as a specific superior to mercury; but experience, which tends more and more to confirm the influence of mercurials, when properly employed in this virulent disease, has done nothing to confirm our confidence in Ammonia, which is, therefore, now seldom used in syphilis.

Ammonia may be given, in its state of Liquor Ammoniæ, in combination with Chloride of Calcium and any of the salts of baryta: but it is incompatible with acidulous salts and metallic salts, except tartarized iron. It may be administered in any bland mucilage or emulsion, or in bitter infusions, or in milk, in doses of from ten minims to half a drachm.

The subcarbonate should never be ordered in the solid form, as it is apt to prove emetic. The dose is from five grains to a scruple, dissolved in any mucilaginous or bitter infusion.

Its influence as a topical excitant shall be detailed under Rubefacients.

Sage, Anal. Chim. des trois regnes, t. i, p. 283.

B.—IMPONDERABLE AGENTS.

These agents may be arranged under three distinct heads:—1. Those which are generally regarded as material,—namely, *Electrical* and *Calorific powers*; 2. *Mechanical Influences*; 3. *Mental Influences*.

* ELECTRICAL AND CALORIFIC POWERS.

a. ELECTRICITY, like Caloric, is diffused over the whole of nature; the earth and every body with which we are acquainted possessing a certain quantity of it. As long as they contain what may be termed their natural share, their *Electricity*, like insensible Caloric, remains dormant, producing no sensible effect; but it can be abstracted from one body and communicated to another in a degree much beyond their natural share. In bodies charged with it, striking phenomena arise; and the bodies are said to be electrified. Those bodies which can be overloaded, as it were, with the electric fluid, and those, also, that have been exhausted of it to furnish this charge, are both said to be *insulated*, when the condition of the surrounding bodies prevent either from altering their state. In this respect, the laws that regulate the motions of Electricity differ from those that regulate Caloric. It has, nevertheless, been supposed that Electricity is a modification of the material agent which produces the phenomena of heat and light; whilst others regard it as a mere power which the molecules of matter exercise: it is unnecessary, here, to enquire into the probability of these hypotheses.

Bodies can be charged with Electricity only to a certain limit, however well insulated the body may be: beyond a certain limit, it gives off the surplus to the nearest conducting substances. The quantity any body can receive is determined by the extent of its surface. It neither adds to, nor abstracts from, the weight of bodies in which it is excited. Every form of matter may be excited to its action; and, as there is a mutual repulsion of the different parts of developed Electricity, substances which are equally charged repel each other, whilst the reverse takes place with bodies unequally charged.

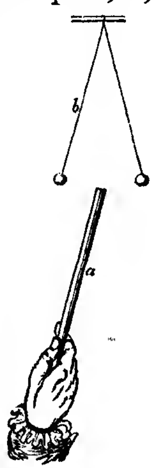
The phenomena of Electricity are striking and easily produced.

Thus, if a piece of amber, on a glass tube, or a stick of sealing wax, be rubbed with fur, or silk, or flannel, a feather will be attracted by it; but, upon contact, it will immediately again fly from it to discharge its now redundant electricity on

the nearest conductor*. But if, instead of a glass tube, a metallic tube be used, no such phenomenon takes place.

All bodies, in reference to their electrical relations, are regarded as *conductors* or *non-conductors*. By this term, *conductor*, is meant any body which is easily traversed by the electric fluid, as is the case with all *metals*, *plumbago*, *charcoal*, *water*, *plants*, *the animal body*, *animal fluids*, *fused chlorides*, *iodides, and salts; strong acids*, *alcohol*, *spermaceti;* whilst substances which are not so easily traversed by it, but on which it can be accumulated, such as *glass*, *sealing wax*, *sulphur*, *baked wood*, *dried animal substances*, *resins*, *oil*, and *air*, are *non-conductors*. The best conductors of electricity, among the metals, are silver and copper; the worst is lead†. Moisture is an admirable conductor; thence, in moist weather, electrical experiments rarely succeed, because the moisture prevents the accumulation of the fluid on *non-conductors*, which are rendered *conductors* by its presence. Thus, a green twig is a conductor, a dry or a baked twig a non-conductor; moist silk is a conductor, dry silk a non-conductor. On the former the electric fluid is supposed to pass with a rapidity equal to light; on the latter its transmission is so slow, that it apparently adheres to the particles composing them. There are no perfect non-conductors.

Electricity may be accumulated on any body which is surrounded with non-conductors: it is then said to be isolated; and it is on this account that persons in whom we wish to accumulate Electricity are placed upon stools with glass feet, glass being a non-conductor. This isolation will be as complete, if, instead of glass, the supporting body be silk, or a cake of sulphur, or resin, or sealing wax, or bees' wax.



When the glass rod, *a*, is rubbed by silk, and approached to two small pith balls, suspended each by a silk thread, *b*, these repel one another: but if the excited rod be approached to one ball, and the silk with which it has been rubbed to the other, then the balls, instead of repelling, if at a moderate distance, will attract each other. These two opposite powers have been termed *positive* or *resinous*‡, and *vitreous* or *negative*§. These latter terms originated in the fact, that a light body—a pith pall—receiving its Electricity from excited glass, will attract a body which has received its portion from excited resin. Electricities of the same name repel, those of contrary names

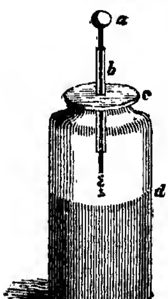
* The term Electricity originated in the observation of this fact in Amber, by Thales of Miletus, 600 years before the Christian era; the name of Amber, in Greek, being ἤλεκτρον.

† Phil. Trans. 1827, part i, p. 21. ‡ Franklin's terms. § Du Fay's terms.

attract, each other: in either case, the force varies in the inverse ratio of the square of the distance. When a body is charged, the electrical fluid is confined to its surface: but its distribution is never equable, except when the body is a sphere.

Electricity is most readily excited in bodies by friction. When two substances, which are non-conductors, are rubbed together, the electrical matter cannot be diffused; but, if another substance which is a conductor be presented to them, the electrical matter is abstracted from them and diffused over this conductor. On these principles the electrical machine is constructed. The Electricity evolved by its cylinder, or glass plate, when put in motion, is derived from the earth; thence the necessity of maintaining a communication between the rubber of the machine and the earth by means of a metallic chain, through which the electricity given to the glass by the rubber is supplied from the earth. It is necessary always, before using an electrical machine, to make it perfectly clean and dry, for which purpose it should be placed before the fire and rubbed carefully with warm silk or flannel*. There are many other modes of exciting Electricity; but it is unnecessary to describe them here.

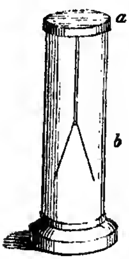
The most common and most useful instrument for accumulating Electricity is the Leyden phial or jar†. If the electrical machine be turned, and the knob, *a*, of the jar be held near to the prime conductor, the electrical matter collected from the earth passes from the conductor into the jar, and is accumulated on the coated surface of its inside; and, as no communication exists between its inside and outside, the charge will remain there for a considerable time. But, if a connection between the two coated sides be established, by means of any conducting substance, the Electricity will immediately pass from the inside, that on which the Electricity of the conductor has been accumulated, to the outside which is oppositely charged; or, in other words, from that side which is electrified *positively*, to the other side, that which is electrified *negatively*, and both will be brought to an equilibrium, or return to their natural state. The passage of the fluid in this case is rendered obvious



* The cushion of the machine must be occasionally supplied with a soft amalgam, made of 1 part of Tin, 2 parts of Zinc fused together, and mixed whilst fluid with 6 parts of Mercury.

† Named from having been invented by Muschenbrock, who resided at Leyden. It consists of, *d*, a glass jar, coated with tin foil on both sides to a certain height. leaving a space uncovered: a metallic rod, terminated by a knob, *a*, descends through a glass tube, *b*, fixed in the cover, *c*, of the jar, and touches, by means of a small chain, the bottom of the jar, which is coated.

by a brilliant spark and a sharp snapping sound. The quantity of electricity which can thus be accumulated depends on the extent of the coated surface of the jar; its intensity, on the thinness of the glass. But if the glass be very thin, the charge perforates the jar, owing to the constrained polarization of its particles becoming so extreme that its cohesion is destroyed. No quantity of matter, provided it be of a nature capable of favouring the current of the electrical fluid, can obstruct this passage, and the time occupied is not perceptible. Thus, if a person holding the end of a chain connected with the outside of a Leyden jar, join hands with another, and this with a third, and so for a thousand, and the last in the circle thus formed touch the knob communicating with the inside of the jar, it will be discharged, and the passage of electrical matter be sensibly felt by all the persons at the same instant. The extent to which this may proceed remains undetermined; but it has been ascertained, by actual experiment, that the charge of a Leyden jar has passed through a space of 1300 feet in a space of time too small to be appreciated*. If, instead of the Leyden jar, a living being be placed on a stool with glass feet, and hold a chain communicating with the prime conductor, electrical matter will be accumulated on his body, and sparks may be drawn from him in the same manner as from the prime conductor. The fact of electricity being thus accumulated in the person isolated, is also proved by the gold leaf, electrometer *a*, in which the leaves diverge, as at *b*, when his hand is held over the instrument. This electrometer is so delicate that it acts when touched by a person placed on a stool with glass legs, and lightly flipped by another person with a silk handkerchief.



On this, the very threshhold of our enquiry, the question arises, what is the cause of these phenomena? One reply only, in my opinion, can be given; "Electricity is matter regulated by certain laws." Experience has taught us this, and also that the material cause of electrical phenomena is spontaneously excited by evaporation, by fusion, heat, and cold, and is also generated in some animals. This is strikingly illustrated in the Torpedo, and the electrical Eel, both of which have an apparatus, forming part of their living system, by which they possess the power of giving a shock, through the medium of the water in which they swim, sufficient to affect other fishes and animals that come near them; and this is a voluntary function.

This view of Electricity is sufficient for our purpose. Its

* Professor Wheatstone has demonstrated that the light of an electric discharge does not last the millionth part of a second of time! The noise which accompanies it is due to the sudden compression of the air.

influence on the animal frame varies according to its mode of application. It may be applied in five different ways.

1. If an individual, placed on an isolated stool*, hold a chain passing from the prime conductor of an electrical machine, the Electricity excited by the working of the machine passes into his body, and is prevented from passing out of it by the isolation of the stool on which he stands or sits. The electrical fluid is therefore accumulated on him; and his body will attract light substances, such as feathers and pieces of paper. This is called the *electrical bath.* Electricity, thus accumulated, increases the action of the heart and arteries, both in force and velocity: and that this does not depend on any mental feeling, is obvious from the fact, that Electricity may be applied to animals asleep, and in them the pulse is quickened. The temperature of the body is also augmented, and perspiration excited—circumstances, however, not depending upon the heating power of electricity, but upon the increased velocity of the circulation†. A clergyman, in whom I could never produce perspiration by any of the ordinary diaphoretics, and who never perspired by exercise, nor the heat of summer, when isolated and electrified, perspired freely. This effect on the skin has been ascribed to the power which Electricity possesses of increasing the flow of fluids through capillary syphons; but, in the living body, it is more probable that it depends on the excitement extending to the extreme vessels.

2. The next method is to present the affected part or member to the prime conductor of the machine, and thus throw on it a succession of sparks; or the patient, placed in a chair, not isolated, may be thus electrified by means of a director‡, connected with the prime conductor by a chain. As soon as the knob is brought within an inch, or even two inches, of the body of the person, a *spark* will be perceived: a sensation of pungency, also, is felt on the part, accompanied with slight muscular contractions; and, if the application be continued for some minutes, redness and inflammation are produced. This is more or less powerful, according to the distance at which the knob is held from the body; and the sparks are greatly dimi-

* A stool or a chair supported upon glass feet; or suspended by silken cords.

† The loss of weight by the perspiration induced by this means is greater than in ordinary perspiration. The Abbé Noillé electrified a cat for four hours, and found that it lost from fifty to sixty-six grains. Plants transpire profusely when they are electrified. "J'ai vu," says De Candolle (Physiologie Végétale, tome iii, p. 1094), "des plantes perdre en quelques heures electrisation une quantité supérieure du quart ou du tiers à celle d'une plante non electrisée."

‡ A brass rod, about a foot in length, terminated at one end by a ball of the same metal, and at the other fixed in a glass handle. The ball should be made to screw off, and points of brass, plain and varnished, and of baked wood, should be made to screw on, when it is removed.

nished in size, if the part be covered with a non-conductor, as, for instance, a piece of flannel.

3. The patient placed on an isolated stool, and connected with the prime conductor by means of a chain, may have sparks drawn from the affected part, by presenting to it an unisolated director. This method conjoins the *bath* with the influence of the spark.

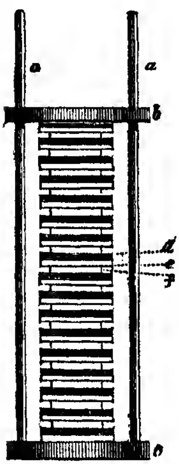
4. Another method of electrification is the *aura*. When this is to be employed, the person who is to be electrified must be placed on the isolated stool; but, instead of holding the chain from the prime conductor, the electrical fluid is to be applied by connecting a pointed director, or one armed with a wooden point, with the prime conductor of the electrical machine, and holding it about an inch or two inches from that part of the body intended to be electrified while the machine is worked. A titillating sensation, resembling that caused by a stream of air, is felt upon the part: and, if the application be continued, both the irritability and the sensibility of the part are augmented. This mode is chiefly applicable to delicate organs, namely, the eye or the ear, and excoriated and ulcerated surfaces.

5. The *shock* is the fifth mode of electrifying. The body is made a part of the electric circuit through which the electric matter is to pass from one side of a Leyden jar to another. Thus, if a charged jar be held in one hand, and the other hand of the person holding it touch the knob of the wire communicating with the inside of the jar, which is charged positively, the electrical matter will rush from the inside of the jar and pass through the arms and chest of the person, as its nearest way, to the outside. To apply this to our purpose:—electrical shocks may be given to any part of the body, without affecting the rest, by bringing that part only into the electrical circuit. If, for instance, the knob of the wire connected with the internal surface of a coated jar be applied to one side of the pelvis, and the extremity of a chain communicating with the exterior of the jar be applied to the opposite side of the pelvis, a shock will be sent apparently through the pelvis; and, if the person be a female, the uterus will be powerfully stimulated. The sensation which it excites is unpleasant, and the muscular contractions are considerable. This mode of applying so powerful an agent requires caution, as animal life may be destroyed if a strong charge be passed through a vital organ. The whole energy of the nervous system is suddenly exhausted, and immediate death follows. The bodies of animals thus destroyed undergo rapid putrefaction, and the blood does not coagulate after death.

It has been supposed that the nerves are the parts of the body which conduct Electricity better than any other; and the truth of this opinion is supported by the discoveries in that

modification of Electricity, which has been denominated Galvanism, and which, from some phenomena attending it, has given rise to an hypothesis, that the influence of the brain and nerves upon the muscles is of an electric nature. Even common Electricity sent along a nerve, either in the living or the recently dead body of an animal, causes contraction of muscles, and, at the same time, in the living animal, a sensation of pain.

The modification of electricity named Galvanism was accidentally discovered in 1790 by Aloysius Galvani, a Professor of Anatomy at Bologna. For some time, however, although this new power was acknowledged to be electrical, yet it was attributed to the animal system, and consequently regarded by Galvani as *animal Electricity**. New experiments, particularly those of Professor Volta of Pavia, soon displayed the error of this opinion; and, by meditating on the development of Electricity at the surface of contact of different metals, Volta invented that instrument which is well known by the name of the *Voltaic pile*†. No effects were produced when the pieces of metal were of the same kind: but strong effects were produced when one metal, easily acted upon by diluted acids, was opposed to one not easily acted upon. The most oxidizable metal was found to be in a state of *vitreous*, and the least oxidizable in a state of *resinous*, excitation. This instrument (see marginal cut) consists of a number of metallic discs, either silver and zinc, or copper, *d*, and zinc, *e*, of the same form and dimensions, and an equal number of discs of card, or cloth, *f*, soaked in salt and water, of rather less diameter than the metallic discs. These discs are arranged in a specific order; for example, on the top of the lowermost disc is placed the Zinc and Copper, on that a cloth disc, then Zinc and Copper again, and so on, until the pile is completed, which is kept together by the wooden frame, *a*, *b*, *c*. If a finger of one hand be dipped in water, or rather in salt and water, and applied to the undermost or Zinc disc, and a finger of the other hand, similarly moistened, be applied to the uppermost or Copper disc, a distinct shock will be felt in the arms, resembling that from a small Leyden jar. If the cuticle of the fingers thus applied be abraded, a very acute sensation will be experienced in the fingers.



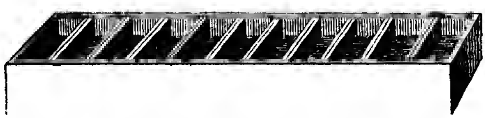
Notwithstanding these effects of the Galvanic pile, it was ill adapted for medical purposes: and, therefore, no progress was made in the application

* Aloysii Galvani de Viribus Electricitatis in motu musculari Commentarius, 1791.

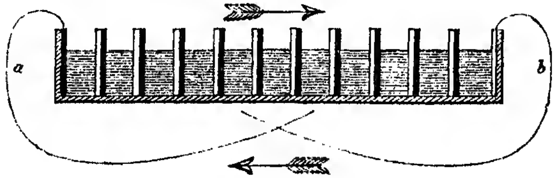
† Phil. Trans. 1800.

of Galvanism as a therapeutical agent, whilst the pile remained the only instrument for exciting electricity by chemical action; although its chemical effects were so powerful, that, with a pile of two hundred pairs of five-inch plates, Van Marum and Pfaff fused an iron wire twenty-eight inches long, and burnt platina wire when drawn out to a fine point. In this pile it is evident that the Zinc plate, the most oxidizable of the two metals employed, give out positive Electricity.

Before investigating the theory of Galvanism, it may be proper to take a view of another machine employed for its development. In 1802, Dr. Wollaston having established the fact that the oxydation of one of the metals, the Zinc, for example, in the pile of Volta, is the cause of the disturbance of the Electricity, and that its activity exists as long as the chemical action between the Zinc and the fluid continues; the Galvanic trough, another instrument employed for the application of this modification of Electricity, was therefore invented. Mr. Cruikshank, the inventor, constructed it on the principles of the Voltaic pile: the metal plates are arranged in the same manner as in the pile; and the only difference is, that instead of moistened discs of cloth or of card, an acidulated fluid is introduced between each pair of the metallic plates, so as to bathe the Zinc on one side and the Copper on the other. Various modifications of this trough are still occasionally employed for chemical purposes; and, with plates of a moderate surface, it was regarded as the best fitted for medical use. In it, the electrical action becomes evident as soon as the acid fluid, which is a dilute solution of sulphuric acid in water,

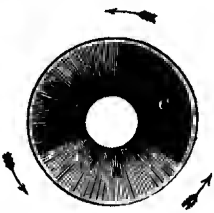


with about one fiftieth of nitric acid, begins to oxidize the Zinc. Whatever metals are employed in the construction of the trough, or whatever be the nature of the fluid used, the metal which is most energetically attacked is *positive* in reference to the other; and the current of the electrical fluid sets in the direction from it to the other, so as to establish a circle. Thus, if we suppose *a* to be a wire proceeding from the Zinc, and *b* a wire proceeding from the Copper, by bringing these together the Galvanic circuit is completed, and the current of Electricity passes in the direction of the arrows.



Although the theory of Galvanism is still sub judicè, yet it has been accurately ascertained that the primary agent in this evolution of Electricity is the force of *chemical attraction*. Now, assuming that this is true, we find that chemical action occurring between a solid and a fluid is always accompanied by the disturbance of the electrical equilibrium; and the natural Electricity of the bodies is changed from a latent into an active state. Thus, if Copper and Zinc be placed in diluted sulphuric acid, the surface of contact between the Zinc and the acid is that at which the chemical action and the development of Electricity takes place, and the Copper merely acts the part of a *conductor* between these two substances. This is the case in all the combinations of oxidizable metals, every metal being positive with regard to another metal which is oxidizable in a less degree: zinc, for example, is positive in reference to *iron* or *copper*; *iron* to *lead*, *copper* to *silver*; and so on.

The marginal diagram is well adapted to elucidate this subject. Suppose the letters A Z C the three elements essential to Galvanic action. "Between the two first of these, A and Z, some chemical affinity must exist adequate to produce combination and development of electricity; while the same degree of action is not exerted between the third element C and either of the former*." One of the two first bodies must be a solid and a conductor of electricity; and, as chemical action requires that one body at least should be in a fluid state, A must, therefore, be a fluid; whilst C may be either solid or fluid. It is requisite, also, that all these bodies be in mutual contact, so as to compose a circle. Now, if we suppose Z A C to be respectively Zinc, Acidulated Water, Copper, the surface of contact between Z and A will be that at which the chemical action, and consequent development of Electricity, takes place: and C will act only as its conductor. The current will therefore circulate in the direction of the arrows, or from A to C, and thence to Z.



Every circumstance which tends to facilitate the passage of the electric current in all parts of the circuit, tends to increase the quantity that circulates; the degree of conducting power, therefore, possessed by the fluid, has an important influence on the power of the apparatus. The conducting power of water is augmented by the addition of salts and acids; a circumstance which is supposed to depend on the high conducting power of these bodies, when their cohesion has been exhausted, as, for example, by solution. The more readily a metal is acted on by

* See an excellent Treatise on Galvanism, published in the Library of Useful Knowledge, of which Dr. Rogett is the reputed author.

liquid conductors, the less is the diminution of intensity which is sustained by the passage of the electric current through it.

This apparatus, the Galvanic trough, was used as an instrument for the application of Galvanism as a medicinal agent. The effect it produces is more or less, in proportion to the number of plates employed; but it does not follow that the greater the power, the greater the number of plates: on the contrary, a certain proportion exists between the number and the surface of the plates, to produce the maximum of power; and increasing either the size or the number, indefinitely, is always followed by a diminution of power. A trough of fifty plates, each containing four square inches of surface, is sufficient for every purpose that can be expected from the influence of Galvanism as a medicinal agent. In using the trough, if shocks are to be given, the fingers should be dipped in salt and water; but, if a stream of electricity is to be passed through any part of the body, brushes dipped in salt and water are to be employed. One, with the positive wire attached to it, is to be held to the part of the body where it is intended to enter, so that the current may pass in the ordinary circuit, the nerves forming the conducting media.

When Galvanism was first employed as a medicinal agent, the common trough was used, and brushes and sponges were attached to the end of the wires, and dipped in salt and water; and these were pressed to the part of the skin where it was wished the Galvanic influence should be chiefly felt. The reason for moistening the sponges and brushes was to augment their conducting power, and the dry cuticle being a very bad conductor. The salt is added to the water to augment its conducting power, which is always in the ratio of the density of the fluid employed.

The use of the trough, however, was found to be far from an efficient mode of applying the electrical influence; and on that account the common electrical apparatus continued to be employed, in preference to the Galvanic trough, when a powerful effect was required. But, after the experiments of Oersted of Copenhagen, Ampere, Faraday, and others, demonstrated the connection between electricity and magnetism, and brought forward that most interesting branch of Natural Philosophy which is termed *Electro-magnetism*, or *Dynamics*, new forms of apparatus have been constructed for medical purposes, which must set aside, altogether, the use of the common electrical machine. It does not belong to our subject to enter into a description of the nature of electro-magnetism; I may merely mention that the most intelligible of the theories which have been given to the public, is, in my opinion, that of Mr. Sturgeon, who supposes that Magnetism and Electricity are perfectly distinct powers: that the former exists in some substances, for instance, the

permanent magnet in a free state, and, in others, in a *latent* or a *quiescent state;* and that the latter is brought into a free or active state by the electrical influence. Thus, if a bar of *iron* be bent into a horse-shoe magnet, and a few yards of copper wire, coated with silk thread, be coiled round it, and the two ends of the coil be connected with the poles of the battery, it will immediately become a magnet capable of sustaining a very considerable weight of iron. It was upon these principles that the Electro-magnetic machine, which I am now about to explain, is constructed.

It consists of a wooden reel or bobbin, round which is first coiled a thick copper wire, insulated by cotton, carrying the battery current; and over this is wound two thousand feet of thin copper wire, coated with silk thread. The commencement and termination of each of these wires is soldered to binding screws attached to the bobbin. The first of these coils is denominated the *primary*, the other the *secondary* coil. In the centre of the helix is a bundle of insulated iron wires, in which, according to Mr. Sturgeon's theory, the magnetic power is evolved; and which, experiments have proved, produce an extraordinary augmentation of power.

When a constant battery* is attached to the machine, a current of electricity is made to circulate through the primary or thick coil of the helix; and when the wheel is turned, and sets the toothed wheel in motion, the contact is alternately made and broken, so as to produce upon those who grasp the cylinders of the conductors a succession of shocks. The hands should be moistened: but few delicate people can bear the severity of such shocks; on which account, and for passing the shocks through particular nerves, sponge directors are employed. The action of this machine is supposed to be the result of the exciting influence of a stream of electricity constantly flowing round the electrified coils, in conjunction with the magnetic power of the temporary magnet: and the experiments of Faraday have proved that motion in the vicinity of a magnet always induces an electric current.

This instrument is well adapted for medical Electricity, not

* The constant Battery was invented by Professor Daniel, of King's College, and consists of any number of cells, such as the following, which I shall describe nearly in his own words. A cell of this battery consists of a copper cylinder, three inches and a half in diameter, in which is placed a smaller cylinder of porous earthenware. Near the upper part, within the copper cylinder, rests a perforated colander, through which the earthenware cylinder passes. A cast rod of amalgamated Zinc is placed in the interior cylinder, resting upon its top by means of a cross bar of wood, and forming the axis of the arrangement. The celled battery is charged by pouring into the earthenware cylinder water mixed with one eighth its bulk of Sulphuric acid, and into the space between it and the copper cylinder the same fluid saturated with sulphate: small masses of Sulphate of Copper being placed in the colander.

only from its capability of action not being affected by damp weather, but also from the long time it can be retained in activity without changing the battery.

It is unnecessary, for our purpose, to say more regarding either modification of Electricity; whether it is excited by friction, or by chemical action: it will be more useful to examine the physiological action of Electricity, and its influence as a therapeutical agent in the cure of diseases.

Electricity, whether *common* or *Voltaic*, applied to the animal system in a moderate degree, increases excitement;—in a greater degree, it destroys life. That it operates on the nervous system is shown in the production of sensation, by muscular contraction, and by altered secretion. The electrical current passed through any part of the body, if continued, by a Galvanic machine, is all along accompanied with an aching pain; and, if the cuticle be denuded, a sensation of burning or acute smarting is experienced; and this is more severe when the electricity flows out of the body, or is on the negative side of the pole. When an electrical current from a common electrical machine is passed along a nerve, distributed to any muscle of volition, the muscle is thrown into convulsive contraction, and the same effect results from Voltaic electricity applied in a similar mode. Involuntary muscles are less easily affected by electricity of either kind; but they are not wholly insensible to this excitant. Its influence on secretion is rendered sensible by the changes it effects on the secretions. Among other experiments illustrative of this fact, M. Most passed a Galvanic current through the parotid gland, for the space of ten minutes, whilst he held the negative pole in his hand; the result was an increased secretion of saliva, which was neither alkaline nor acid. On the lower animals, smart shocks appear quickly to destroy life; but, on frequently passing gentle shocks through the heart of the animal thus apparently dead, oscillations of the muscles take place; and if these be continued for some time, the animal recovers; if they be too soon suspended, it relapses and dies. The vital organs are more excited by slight shocks than by strong shocks. As an excitant, therefore, Electricity acts equally on the sensibility and the irritability of the system; and it is upon these grounds that it has been employed in the treatment of diseases. It is highly diffusible: it is quickly propagated over the system, and excites the action of the most distant parts: and, after its effects are produced, it leaves the body free from those secondary results which more or less follow the action of other excitants. As an excitant, it is indicated in all diseases of debility. Much, however, depends on the mode of applying it. If common Electricity be used, the simple *accumulation* of it ought to be first tried; then *aura;* next *sparks;* and, ultimately, when the body has accom-

modated itself to the Excitant, if requisite, *shocks* may be given. If the *aura* be preferred, it should be applied for ten minutes each time; seldom more than twenty *sparks* should be given at once; nor should more than ten *shocks* be passed in one direction. In a very delicate frame, a strong shock may do mischief, by exhausting too greatly the excitability; thence, in nervous habits, it may not only induce syncope, pain, vomiting of blood, and paralysis, but so exhaust the strength of the patient as to accelerate, and even cause death*.

If Galvanism be employed, it must never be forgotten that there is a distinction in the excitement of the different poles acting upon the vascular and the nervous systems. The positive pole more especially influences the vascular and muscular systems, the negative pole the nervous system. To illustrate this by a practical example, let it be supposed that we wish to resolve an indolent tumor by means of Galvanism. If we pass through it a stream from the positive pole, it will probably become harder, inflame and suppurate, from the increased excitement to the vascular action: if we use the negative pole, which will stimulate the nervous energy of the part, the tumor will be, most probably, resolved.

The therapeutical employment of Electricity and Galvanism shall be afterwards noticed.

5. CALORIC.

Caloric, like some other substances, is known to us only by its effects: it produces the sensation which we term *heat*. We therefore conclude that it is an Excitant. Some philosophers maintain that Caloric is merely a property of matter; it would be out of place here to examine the truth of this opinion; it is sufficient to say that the idea of the materiality of Caloric prevails.

Caloric is unknown in its perfectly free or uncombined state; for it pervades all bodies and passes from one only to enter into another. For practical purposes, we may use the term *free* or *sensible Caloric*, to imply that state of its existence by which its presence in any substance is obvious either to our senses or to the thermometer: and that of *combined* or *insensible Caloric*, to imply its presence when it is neither evident to our senses nor to the most delicate thermometer. Thus, if a quantity of water be placed in the open air, in a freezing day, and remain *perfectly undisturbed*, it will be cooled below the degree at which water usually freezes, and yet remain liquid; but, if it be then agitated, as much caloric will instantly be

* Percival's Essays, vol. i, p. 393.

evolved, as if it were shaken out of the water, as will raise the thermometer to 32°, and the water will immediately freeze. In this case the combined caloric of the water maintains its fluidity; but, on agitating the water, it at that instant becomes *free Caloric*, which raises the mercury in the thermometer, whilst the water, having lost the Caloric that maintained its fluidity, becomes solid or frozen. Again, a quantity of ice, in a pan placed on the fire, melts, but does not raise the thermometer above 32° until the last portion of the ice be melted. In this case, the Caloric which flows from the fire becomes insensible, or is combined with the water to maintain its fluidity; and only the redundant Caloric, received after the whole is melted, affects the thermometer. Different bodies, at the same temperature, contain different quantities of Caloric: this is termed the *specific Caloric* of bodies; and many ingenious experiments have been made to determine the quantity contained in various bodies*. *Free Caloric* only requires our attention.

It is of importance, for our purpose, to trace the sources of Caloric. The *sun* is the chief source; but whether the Caloric which reaches the earth's surface be emanated from the sun with the particles of light, or whether the particles of light acquire the Caloric in their passage through the earth's atmosphere, it is impossible for us to determine. The temperature produced in bodies by the direct rays of the sun seldom exceed 120° Faht. The second source is *chemical*. It is unnecessary, for our purpose, to inquire whether the heat and the light produced by *combustion* arise from the simple union with oxygen of one or more parts of the combustible body, as Lavoisier supposed; or whether, according to Brugnatelli, oxygen unites with bodies in two states; namely, one in which it retains the greater part of the Caloric and light which it contained in its gaseous state; the other, in which the union takes place only after it has parted with these; or whether it is an electro-chemical phenomenon, as Berzelius has supposed. I will not, therefore, pause to examine the theory of this process, during which both light and heat are largely emitted, and rendered subservient for stimulating the animal body, in a degree proportionate to its necessities.

Mixture is also a chemical source of Caloric. This is owing to the specific gravity of the mixed body being greater than the mean of its components; as when strong sulphuric acid is mixed with water.

* The specific heat of the solids and fluids of the living body is less than that of water; the quantity of combined Caloric, therefore, in the whole human body is rather less than in an equal quantity of water at the same temperature; for the inferior capacity of the venous blood more than counterbalances the superior capacity of the arterial blood.

The third source is *mechanical*. *Percussion*, it is well known, evolves much caloric: a rod of iron, rapidly hammered, becomes red hot; and sparks are elicited by striking flint upon steel.

Friction also evolves Caloric. It is evolved from organized as well as unorganized bodies by this means. M. Becquerel's experiments have demonstrated that when a rough body is rubbed against a smooth body, the former becomes hotter than the latter. They have, also, proved that substances of a different kind, when rubbed together, are differently affected: ground glass, for example, becomes hotter than cork in the proportion of 40 to 7.

Two pieces of wood rubbed together with great velocity will evolve so much heat as to cause combustion. It is not easy to explain why Caloric is accumulated by friction: something may be due to the agency of *electricity*.

The fourth source of Caloric is *Electricity*. The spark elicited in discharging an excited body through the air fuses metals and sets fire to combustible bodies.

The fifth source is *vitality*. This is demonstrated to us by our sensations; and when the vital principle in animals is extinct, the heat of the body is regulated solely by external circumstances. Caloric, indeed, is generated by living animal bodies; and it is this faculty which enables man and other animals to resist the extremes of cold. As this is a vital process, it is greatly influenced by the state of the nervous system; but it is, also, in some degree dependent on chemical changes going on under the influence of the vital powers. In this country, the lowest average heat of the human body is 88°; the greatest heat, in the state of disease, is 110°.

With respect to the *distribution* of Caloric, bodies which contain more free Caloric than the air and other bodies that surround them, emit it, and continue to do so until the whole come to an equilibrium. This power of Caloric to be *communicated* from one body to another varies according to the nature of the body communicating it: that body into which it most rapidly enters communicates it most rapidly: and it is on this account that bodies of the same actual temperature give a different sensation to the touch: thus, a piece of flannel, a piece of leather, and a piece of iron, all of the same temperature, will seem cold, colder, and coldest, in the order named; the flannel cold, the leather colder, and the iron coldest. The Caloric is given out in straight lines, or is *radiated;* it is subject to reflexion, absorption, refraction, and polarization, the same as light: the manner in which this is effected is regulated by laws which it is not in my province to explain, but the knowledge of which is important to the physician. Thus, by knowing that surface affects the radiation of heat, if I wish to apply heat by means of hot water rapidly to the living body, I would put the

hot water into a tin vessel painted black and covered with linen; if I wish to convey the heat more slowly, but to keep it up for a long time, I would put the hot water into a *bright* tin vessel without any linen around it.

When Caloric enters into a body, it does not augment its weight, although it accumulates to an extent sufficient to increase the bulk of the body: but the quantity of Caloric which can thus be accumulated, depends on the conducting power of the body. Solid bodies are the best conductors; gases the worst. In raising the temperature of 1000 cubic inches of glass from 32° to 212°, they expand to 1001 inches; 1000 parts of water, to 1046; 1000 of air, to 1373. But all solids, all fluids, and all gases, do not conduct alike. Metals are good conductors; glass is a bad conductor. An iron rod, with one end in the flame of a lamp, will become so hot, in a few minutes, as to prevent it from being longer handled; whilst a glass rod may be held in the hand until it is nearly all melted away. The small conducting powers of wool, silk, feathers and down, and hare's fur, admirably adapt them for clothing, as they do not permit the Caloric, generated in the body, to be rapidly carried off by the cold external air*. Animal bodies are bad conductors. The knowledge of the conducting power of different bodies enable us to regulate the employment of Caloric advantageously in the form of *baths* and *fomentations*.

The following facts are all that are required to be known regarding Caloric as a therapeutical agent:—1st. That it is a material body or substance, contained in all organized and unorganized bodies: 2nd. That when it is contained in a larger quantity in a free state in any body than in other surrounding bodies, radiation takes place, and it passes from it into them: 3rd. That it increases the bulk of all bodies into which it passes: 4th. That it becomes free or sensible when bodies pass from a gaseous to a fluid, and from a liquid to a solid state, and vice versa: 5th. That it passes through various bodies with different degrees of velocity; and, finally, that on entering the living animal body, it excites the nerves of sensation.

On the living body, the first effect of *free Caloric* is to stimulate the nervous system, augmenting the irritability and exciting motion. This is obvious, even in the earliest state of organization, as Harvey demonstrated by his experiments on the egg. In a low temperature, the punctum saliens, or vital speck in the egg, beats slow and languidly; in a higher temperature its motion is more vivid; and this alternates according as the

* Count Rumford, examining the number of seconds which elapsed during the passage of the thermometer through 135 degrees, during the cooling of different bodies, found their non-conducting powers to be as follows:—Lint, 1032; Cotton Wool, 1046; Sheep's Wool, 1118; Raw Silk, 1284; Beaver's Fur, 1296; Eider Down, 1305; Hare's Fur, 1315.

Caloric is abstracted or applied. It is on this account that both plants and animals arrive sooner at maturity in the torrid zone: that women become mothers there at ten and twelve years of age; and in Lapland not until they are twenty-four. But the excitement caused by Caloric is soon followed by debility and exhaustion; on which account the inhabitants of the torrid zone are more languid and feeble than those of temperate climates.

Caloric, when applied to the living body in a degree above 68° Faht., increases the secretions in quantity, and alters them in quality. Thus, perspiration is greater in a warm atmosphere than in a cold; its chemical properties also are changed; it becomes more acrid; and, when a European first visits any country within the tropics, this acrimony displays itself in a cutaneous eruption, Eczema *solare*, or prickly heat. The augmented excretion of the skin lessens the secretion of the kidneys, and renders it more saline and high coloured; consequently diseases of the urinary organs are more frequent in warm than in cold climates. In the alimentary canal also, the secondary effects of Caloric are felt: true Dyspepsia supervenes, and Excitants, which Nature has bountifully provided in these climates, become necessary for sustaining the tone of the system. The liver also becomes affected in a high temperature, long continued, particularly in those who go from colder to warmer climates: the biliary secretion is augmented in quantity, and its character altered. Cholera and Hepatitis, therefore, are the prevailing diseases of warm climates. Heat is also the most general predisposing cause of fevers, by increasing the irritability of the system, producing debility, and thence inducing a vitiated state of the secretions; which, reacting on the habit, produce febrile action. Several of the Phlegmasiæ, besides Hepatitis, are also produced by the direct influence of heat, and are endemic in warm climates. Tetanus is another disease of the torrid zone, depending on increased irritability arising from the continued impression of heat. Dyspnœa is often the result of a hot atmosphere.

Besides increasing the irritability of the system, the introduction of Caloric into it augments, also, its *sensibility*. Thus Caloric passing into the living body produces the sensation of heat; and, at the same time, renders the body more susceptible of every other impression. The intensity of sensation from this cause depends on three circumstances—1, the state of the sentient nerves; 2, the velocity of the impinging Caloric; 3, the nature of the conducting medium.

1. The influence of the *condition of the sentient nerves* is daily demonstrated. A body of a temperature under 60° will impress the sensation of warmth or of coldness, according as this temperature be higher or lower than that of another body which had been just previously touched: for instance, if the hands be put into fluids of different temperatures, say 36° and 96°, and

then both plunged into water at 60°, to the hand which was in the water at 36° the water at 60° will feel hot, whilst to the other, which had been in the water at 96°, it will feel cold.

2. With respect to the influence to be attributed to the rapidity with which the Caloric flows into our bodies, much depends on the conducting power of the substances applied to the body: if mercury be taken as the standard, and reckoned as 1000, we shall find dry air to be 80, moist air 330, and water 343*. Water and air of the same temperature thus produce very different sensations on the body: and also, from the greater conducting power of moist air than that of dry air, we feel cold in damp weather of the same temperature as that which produces an agreeable feeling of warmth when the air is dry: and, if the atmosphere be agitated by wind, we feel colder than would be the case from the actual temperature of the air. On the same principle, we are more sensible of the impression or the abstraction of Caloric from metals, than from wood of the same temperature.

3. With respect to the conducting medium of Caloric as an Excitant, it may be applied through different media; namely, through *aeriform media, including vapours ; fluid media ;* and *solid media.*

a. Aeriform media.—When the body is exposed to dry, highly heated air, the Caloric operates as a powerful Excitant, producing headache and accelerating the pulse. Air, however, does not act as an Excitant until it reach 98°. At this temperature, the sensibility and general energy of the nerves, and the action of the heart and arteries are increased; and, as the last effect extends to the cutaneous capillaries, the perspiratory function is also rendered more active; and therapeutical effects follow, which shall be afterwards noticed.

There are conditions of the body in which the direct application of hot air may prove beneficial: thus, in cases of suspended animation from drowning, as hot water is not always ready, hot air may be employed in its stead: it is also an excellent means of communicating external warmth to the body in the cold, blue condition of it which characterizes the state of collapse in Asiatic cholera. In order to increase the stimulant power of hot-air baths, sulphur† and other substances of a volatile nature are employed, and form part of the heated atmosphere with which the patient is involved. Baths of this description have of late years been much used for the cure of some cutaneous eruptions, and obstinate cases of chronic rheumatism.

Although the body is less capable of resisting the same de-

* Experiments of Count Rumford.

† What are termed sulphur baths consist of a box for holding the body, with the exception of the head. When the person is seated in it, the sulphur is placed on a heated plate below the bath: it is volatilized, and partly converted into sulphurous acid.

gree of temperature in moist air than in dry air, yet a much higher temperature can be borne in *vapour* than in *water*. The heating power of the former is much greater when the vapour is breathed, than when the head is not immersed in it. The following table* displays this difference, and, also, the temperature of water to which the vapour bath is equivalent under each of the conditions alluded to.

	WATER.	VAPOUR.	
		Not breathed.	Breathed.
Tepid bath	85° — 92°	96° — 106°	90° — 100°
Warm bath	92° — 98°	106° — 120°	100° — 110°
Hot bath	98° — 106°	120° — 160°	110 — 180°

The vapour bath operates more like a narcotic than the warm air bath: it first excites, adding both force and frequency to the pulse and quickening respiration; effects which are followed by languor and drowsiness. Those accustomed to the use of the vapour bath—for example, the Russians—can sustain vapour even when breathed of a temperature of from 120° to 130°, some even to 160° Faht.

The simplest vapour bath, when the vapour is not breathed, is that of the Hindoos. The patient is stripped naked; and, a blanket being pinned round his neck, so as to envelope the whole body, he is seated on a low stool: an earthen vessel is then introduced within the blanket; and, boiling water being poured into this vessel, the opening of the blanket is well secured by pins. In a few seconds, the patient begins to feel the warm vapour encompassing his body and his temperature increasing, until the system relieve itself by a copious perspiration. If it be requisite to maintain the effect, hot bricks are thrown into the water at different intervals, so as to renew the supply of vapour. The chief recommendation of this bath is the facility of employing it at the bed-side of a patient, even without wetting the floor of the apartment.

But no vapour-baths, to produce a powerful effect, are equal to those of the Russians. In St. Petersburgh, they are on the most magnificent scale, emulating those of ancient Rome†. The

* Cyclop. of Prac. Med. vol. i. Bathing.

† Gibbon thus describes these splendid edifices: "The baths of Antoninus Caracalla, which were open at stated hours for the indiscriminate service of the senators and the people, contained above sixteen hundred seats of marble; and more than three thousand were reckoned in the baths of Diocletian. The walls of the lofty apartments were covered with curious mosaics, that imitated the art of the pencil in the elegance of design and the variety of colours. The Egyptian granite was beautifully encrusted with the precious green marble of Numidia; the perpetual stream of hot water was poured into the capacious basins through so many wide mouths of bright and massy silver; and the meanest Roman could purchase, with a small copper coin, the daily

first or outer room, in which the bather undresses, is of a temperature between 75° and 100°: at first, this dry heat produces a slight headache and an uncomfortable feeling; but the excitement is soon relieved by a general perspiration; and the heat of the apartment gradually becomes more tolerable. The bather is then introduced into the bath-room, the temperature of which is from ten to twenty degrees higher than that of the outer room; and this increases as the bather gradually, at intervals of a few minutes, ascends different benches, ranged one above the other, until he almost attains to the ceiling of the room, where the temperature is at least 180°, and, to any one not accustomed to this luxury, is insupportable. The head now feels oppressed and burning; the skin is hot; and the respiration difficult. The attendant, who is termed in Russian the *Parilstchick*, now feels the skin of the bather; and, if it be not bedewed with perspiration, he opens the door of the stove and throws into it a bucket of water. The atmosphere of the bath is instantly pervaded with clouds of vapour; a deluge of perspiration streams from every pore of the skin; the breathing is relieved; the headache disappears; and a general pleasurable sensation is experienced. The relaxation which follows this application of the vapour may readily be conceived: a sort of shampooing, with soap-suds and the inner bark of the lime tree, is now assiduously performed by the *Parilstchick*, kneading as it were the muscles, and pressing on every joint; and the operation terminates by dashing tepid or cold water, at the pleasure of the bather, on the head and even over the body. The Russians, who use this bath at least once a week, are not contented with the highly exciting power of the Caloric, but have the body whipped with twigs of birch; and the poorer Russians, in the state of profuse perspiration, rush out of the bath, roll themselves in the snow, and then return to finish the bathing. The benefit derived from the use of these baths can be attributed only to the Caloric in the first instance exciting the heart and arteries, and afterwards equalizing the circulation by the force with which the blood is thrown into the capillaries. The glandular system is also powerfully stimulated: the secretions are facilitated; and a general impulse is given to the nervous energy. The vapour bath, however, whilst it is more diaphoretic, is less excitant than the hot water bath. It is a curious fact, that the vapour is employed by the savage tribes of America. Lewis and Clarke, in their voyage up the Missouri, describe a vapour bath which they saw in the rocky-mountains. It consisted of a hollow square, six or eight feet deep, formed in a river by three mud walls, the bank forming

enjoyment of a scene of pomp and luxury which might excite the envy of the kings of Asia." From these baths the Romans issued, steaming with perspiration, and plunged into the Tiber, in the same manner as after the violent exercises of the Campus Martius

the fourth, and covered over, except a hole through which the bathers descended. A number of hot stones is taken into the bath, and the vapour formed by throwing the water upon them. After perspiring profusely, the bather comes out of the bath and plunges into the river. This bath is employed as a luxury, and, also, as a therapeutical agent.

b. Fluid media.—Caloric, combined with water, is employed as an Excitant in the form of tepid, warm, and hot baths; each being of the temperature expressed in the foregoing table.

Warm baths have been used from time immemorial as an article of luxury; they were in common use among the Greeks; and, from what has been handed down to us of the magnificence of the Roman bath, the importance in which that people held warm bathing is evident. The use of the warm baths was judiciously imposed as a religious duty upon the inhabitants of Asia, who, living in a warm climate, wearing sandals, and woollen garments which are seldom changed, thus requiring the use of the bath for the preservation of their health. The ablutions, therefore, enjoined by the laws of Moses, and those of Mahomed, were wise and salutary. In modern Europe, the use of the warm bath, except in Russia, can scarcely be regarded as general; and in Great Britain it is viewed rather as the means of removing diseases than of preserving health.

Water, at the same temperature as air, feels warmer to the body, merely because it is a better conductor of Caloric than air: at a temperature higher than that of the body, it rapidly communicates Caloric; at a temperature beneath that of the body, it as rapidly abstracts it. Water feels cool to the surface, on first immersing the body, if the temperature do not exceed 85°; and therefore no bath is termed even *tepid* until it exceeds 85° Faht.

When the body is immersed in the *warm* bath, whether natural or artificial, at a temperature of 92° and 98°, an agreeable sensation of warmth is perceived, the veins on the surface swell, the bulk of the body is sensibly increased*, the skin becomes redder than natural, it also softens, and minute scales separate; the action of the heart is augmented, the pulse feels soft and full, but beats quick; as soon, however, as the person rises from the bath, sweat breaks out, and this even occurs when the person is in the bath, on those parts of the body not surrounded with the water: languor and debility follow. But, even below this degree, the bath feels hot or cold according to the condition of the bather. If the temperature ascends to 92°, it communicates an agreeable warmth, softens the skin, promotes perspiration, and allays thirst: This bath, however, is more frequently employed as a luxury than a therapeutical agent. These effects proceed partly from the immediate impression of Caloric on the

* The air expands one 480th of its volume at 32° for every degree of Fahrenheit; thence the augmentation of the bulk of the body is easily understood.

sentient nerves of the skin, and partly from this first impression producing a state of the capillaries which, at the moment, is inconsistent with the perspiratory function—a state somewhat approaching to that of the extreme vessels which checks perspiration in acute fever: but the degree of heat being inadequate to maintain this effect, and the water, now that the temperature of the skin is greater than itself, acting as a cooling medium, relaxation follows; and therefore the warm bath, in its general action, is a cooling agent. On the same account, the warm bath has a peculiar tendency to alleviate irritation, and consequently to induce sleep.

When the *hot* bath is employed, that is, when the body is immersed in water of a temperature between 98° and 106°, or as high as the individual can bear it, the heart and arteries are powerfully excited; the face, as well as the rest of the body, becomes red; the temples throb, and the pulse is felt, even at the finger ends. The collapse, however, is proportional to the excitement; and, consequently, much greater after the hot than after the warm bath. We may regard the warm bath as an Excitant, when the immersion is not prolonged beyond eight minutes; but, beyond that time, a relaxant and sudorific: the hot bath, under the same circumstances, is strictly and powerfully excitant.

The first effect of the warm and the hot baths, independent of the impression which they produce on the nerves of sensation, is the expansion of the bulk of the body: but, whilst we are convinced of this by our clothes feeling tighter than they were before, after having been in the warm or the hot bath, yet it is uncertain to what part of the frame this increase of bulk or expansion takes place. Sauvage exposed the blood to various temperatures, from 32 to 112, and found that it experienced no mensurable increase of bulk: and even between 112 and 212, the increase of volume did not exceed $\frac{1}{300}$ th part; the result of Haller's experiments was the same. Neither does any increase take place in the solid living fibre; we must, therefore, refer it in part to the elastic fluids contained in the blood and other parts of the body. Something is also due to the diminished resistance of the skin relaxed by the bath; and this accounts for the greater enlargement of the veins than of the arteries; for, as the veins are more superficial, and scarcely contractile, they suffer more readily a temporary congestion and enlargement.

Is any of this increased bulk due to the absorption of water? The experiments of Dr. Currie first threw a doubt on the absorbing power of the skin. He supposed that no absorption could take place unless the skin be eroded by friction; and, if any increase of weight take place, that it must depend on absorption by the lungs. After an hour's immersion in the Buxton bath, at a temperature of 82°, he found that the weight of the body was rather diminished than increased. Many experiments

of Seguin tended to confirm this opinion, and to prove that the great impediment is the cuticle; for if this be removed, absorption goes on. Dr. Rousseau of Philadelphia has nevertheless demonstrated, that the skin possesses the function of absorption in a small space (Part i, p. *8); whilst the experiments of Dr. Edwards tend to confirm the general absorbing power of the skin. In a temperature from 50° to 70° Fahr. Dr. Edwards says the exhaling and absorbing powers of the skin are balanced; above 70°, the transudation exceeds the absorption*. But as many equally well-conducted experiments exclude all idea of cuticular absorption, it is evident that the subject requires further investigation.

The warm bath softens and smooths the skin. The exterior part of the cuticle rubs off in the form of scales, which are in a partial state of decomposition; for the water used as a bath, in which they are mixed, putrefies rapidly. By the removal of these scales, the function of perspiration becomes freer than before; thence one cause of the benefit derived from the use of the warm bath, even to the healthful. Besides this superficial effect, the relaxant influence of the warm bath is undoubtedly extended to the muscular tissue.

It is to the influence of Caloric, however, on the irritability of the system, that we are to attribute the increased action of the heart and arteries in the warm and hot baths. But, it may be asked, in what ratio is the arterial action accelerated? In the warm bath, the pulse, at first, is seldom below 96°; but, after some time, this diminishes; and, if the immersion be long continued, it sinks below 68°. In a bath heated to 104°, Dr. Parr found the pulse increase both in vigour and frequency after the person had been immersed for twenty minutes: and even after half an hour, in a bath at 102°, the arteries beat violently to the ends of the fingers; the breathing became laborious; the vessels turgid; the face flushed; and sweat broke out. In water at 106°, the velocity of the pulse was greatly increased; in five minutes, vertigo supervened; and the most copious sweat followed. In fifteen minutes after the use of the bath, the patient being in bed, the pulse returned to its natural standard of velocity; but it remained full for some time†. From these facts, we may conclude that the arterial action is augmented in the ratio of the temperature of the bath, and the time in which the patient is immersed; and that, consequently, according to the mode of using it, either excitement or relaxation may follow the use of the same bath. To obtain the first, the patient must remain a short time only in the bath; for the second, the immersion must be protracted.

* De l'influence des agens Physiques sur la vie. Paris, 1824.
† See Parr's Inaug. Thesis de Balneo. Edin. 1772.

The natural baths which come under the denomination of warm and hot baths (*Thermæ*), are those of Bath, the temperature of which is from 96° to 106°, although the water issues from the spring at 116°; those of Toeplitz, 113° to 122°; Ems, 117° to 131°; Baden baden, 153½°; Gastein, 120°; Wisbaden, 158°; Vichy and Barege, 120°; Borset, 132°; Aix-la-Chapelle, 143°; and Carlsbad, which is 122° to 167°.* The great advantage of many of the natural warm baths is the benefit of locomotion of which they admit. But, in this country, both *warm* and *hot* baths are generally artificial, and much ingenuity has been expended in inventing easy means of heating water for the purpose of baths.

The partial means of using warm and hot water are various. The partial baths are—1, the *semicupium*, or half bath, in which the lower limbs and the trunk as far as the hips only are immersed: 2, the *balneum coxæluvium*, or hip bath, which, as its name implies, is fitted to receive the hips only, and has the advantage of requiring very little water; as the bulk of the parts immersed, in proportion to the size of the bath, raises the water on each side so as completely to cover the hips: 3, the *pediluvium*, or foot bath, which takes in both the feet and the lower limbs, and which should always reach as far as the knees: 4, the *manuluvium*, or hand bath; which, in general, should be used at the same time as the foot bath, when the intention is to relieve the head or the chest by counter-irritation†: 5. *fomentations* by means of flannels wrung out of hot vegetable decoctions, and hot water: 6, *poultices:* and 7, that mode of applying hot water which the French term *la Douche.*

The four first of these partial baths influence the habit nearly in the same manner as the general warm or hot bath, varying in their effects according to the temperature at which they are employed.

5. *Fomentations.* The simplest kind of *fomentation* is a flannel cloth or sponge, soaked in hot water, and wrung or squeezed dry before being applied to the part which is meant to be fomented. In order to explain its operation, we must have recourse to the laws that regulate the action of Caloric; and we find that those substances, being spongy and involving much air, are bad conductors of heat; that they, therefore, cool slowly, and thence enable the Caloric, in conjunction with aqueous vapour, to be applied for a time sufficiently long to prove beneficial. It is customary to use vegetable decoctions—namely, those of Chamomile flowers and Poppy heads, with the flannel

* The springs at Carlsbad are the Schlossbrunn, 122°; Muhlbrunn, 136°: Neubrunn, 144°; and Sprudel, 167°.

† A very important improvement might be made in the vessels employed for these partial baths, by making the sides double, so that a layer of air, which is a bad conductor, would be interposed between the water in the bath and the external air.

or the sponge; and, although it is pretty clear that these substances are not absorbed, yet it is equally certain that decoction of Poppy heads adds much to the soothing effects of fomentations; apparently from their influencing the sensitive nerves of the skin. A greater quantity of Caloric can be applied in fomentations than can be borne either in the form of water or of vapour as a general bath; but the heat cannot be so long maintained. The temperature of the flannels should not be under that of 100° Faht.; and, when applied, they should be covered by dry flannel cloths laid over those used to convey the Caloric, in order to moderate the cooling of the fomentation. The flannels should be at least three yards long, and the ends sewed together: they should be quickly wrung dry by sticks passed through them, and turned in opposite directions; then applied as lightly as possible over the parts fomented; and the whole enveloped in dry flannel. Our knowledge also of the radiating powers of Caloric is necessary to direct us to the choice of the colour of the flannels to be employed. Thus, if a sudden heat, without reference to its permanency, be required, black or dark-coloured flannels should be chosen; but if a moderate long-continued heat be desired, white flannel should be used.

Fomentations are valuable remedial agents in all cases of inflammation and spasm on the surface; as well as in deep-seated inflammation and spasmodic action, such as occurs in colic. They are highly beneficial in inflammatory affections of the membranes, as in gout and rheumatism; and whenever there is a morbid tension, whether accompanying inflammation or not, from too copious a transmission of blood to a part, and the retention of it, as in piles and in many local diseases.

In insanity, the value of warm fomentations was known so early as the time of Cœlius Aurelianus, who ordered warm fomentations to be applied with sponges to the eyelids, under the supposition that their effects penetrated to the membranes of the brain. It is unnecessary to refute the absurdity of this opinion: but, at the same time, we must agree in the justice of the remark, that although "we may not be quite satisfied with the anatomical and physiological knowledge of Cœlius, yet we must recollect that he treats very ably of the cure of *Insanity*, and that he doubtless had experienced good effects from this topical application of warm fomentations*." Much caution, however, is necessary in determining the proper period for using either fomentations or baths in insanity.

In a disease of more frequent occurrence, catarrh affecting the Schneiderian membrane, nothing assists so much the removal of the inflammation in the nostrils and frontal sinuses as foment-

* Burrows' Commentaries on Insanity.

ing the nose and forehead with a large hollow sponge squeezed out of hot water.

6. *Poultices* are merely modifications of fomentations. They may be made of any substance that is viscid, soft, and spongy; but the best material is linseed meal and boiling water. They should be light, and rather frequently repeated than bulky. The most ancient poultices on record was made of figs. It was employed for the relief of Hezekiah, one of the Kings of Israel, who lived 260 years before Hippocrates. The passage is in the Second Book of Kings, in the twentieth chapter and seventh verse—"And Isaiah said, take a lump of figs. And they took it and laid it upon the boil, and he recovered."

Poultices are preferable to fomentations in some cases. They are chiefly used in allaying tension and pain in local inflammation, where the inflammatory action, being confined to a part, thickens it: by keeping up a proper degree of heat for a certain time, the morbid action terminates in suppuration. Poultices operate on the same principles as fomentations and the warm and vapour baths: their use, therefore, may be greatly extended. Thus, for instance, as perspiration is induced on the part, and much soothing follows their application, I would employ them in internal spasmodic affections, accompanied with pain; namely, colic and peritoneal inflammation. For the latter disease, they may be made with a strong decoction of poppy-heads, instead of plain water. In such cases, also, they should be spread out thin upon cloths, and very frequently repeated.

7. The last local mode of applying Caloric in combination with water, is the partial effusion of hot water (*Illisus aquæ*), or *la Douche**, as the French term it. The principle of its operation is certainly not understood. It consists in directing upon the part to be douched, a column of water at a temperature within the limits constituting the warm bath; from such a height as to act like percussion on the part. It excites the vitality, exalts the sensibility, and quickens the vascular action, not only in the affected member, but in the neighbouring parts. The effect is modified by the temperature, the magnitude, and the elevation or descent of the column of water, and the period occupied in its application. The sensation is that of fatigue in the part submitted to the douche; and this is followed by relaxation not only of the rigid limb, but, if the patient be properly managed, a general effect is produced and extended to the whole system†.

The difficulty of applying Caloric in combination with water

* Doccia of the Italians.

† The baths of the Greeks were chiefly a modification of douching: the bather sat in a basin and the water was poured over him. In the time of Homer, cold water was first used and then warm water.

in this manner, in private practice, depends on the almost impossibility of getting the stream of water of a sufficient magnitude, and the fall of a sufficient height. Nature has furnished the douching warm baths in several parts of the world: among the most justly celebrated are those of *Aix les Bains* in Savoy; the method of using which is so well described by Mr. Bakewell, that I make no apology for quoting his description nearly at length. "Till the year 1772," says Mr. Bakewell, "the sulphur bath at Aix les Bains was merely a large cave cut in the rock, and divided by a wall into two apartments, one for the men, the other for the women, with an iron ballustrade in front. At that time the King of Sardinia caused the present handsome building to be erected and fitted up, expressly for the operation of douching. Each bath or cell is an arched vault, about thirteen feet long, eleven wide, and twenty-two feet high from the top to the place where the patient sits. There are two apertures, or short tubes, by which the water descends in columns, as large as the arm, from the height of from eight to ten feet; it is carried off by channels in the floor, and runs down into the street. There are two men, called *douchers*, constantly in each of the cells for men: and two women, *douchesses*, in each of the women's apartments. Porters are also in attendance to carry the patients in chairs provided by the establishment. These chairs are placed on poles, with cotton hoods or curtains, so as entirely to cover the patient.

"It is the general custom to begin by taking one or two warm baths at home. To persons who take the douche for the first time, the process is rather formidable. On entering the cell, when the door was closed, I seemed in darkness, and involved in dense vapours and sulphurous odours; but as my eyes became accustomed to the gloom, I could discern a feeble glimmering of light, entering by a little wicket above the door, covered with canvass. I then discovered two silent and nearly naked figures, whom I had not before perceived, standing with their bare arms extended, as if ready to seize me the moment I was undressed. It would have required no powerful aid of the imagination, in such a place, and amid the gloom and sulphurous vapours, to have transformed these figures into demons or tormentors of the Inquisition: and the horrid yells of the douchers in the neighbouring cells, to call the porters, might have confirmed the belief. On approaching the flight of steps where I was to descend to take the douche, I drew back my foot, as I could not see where to set it down. This they attributed to fear, and cried out, 'N'ayez pas peur: soyez tranquille; nous vous menagerons doucement comme un enfant gaté.' They then brought me under one of the streams of water that issue from near the top of the cell, and told me to extend my hands in order to break the column of water, and

distribute it over my body, as it would be too painful and scalding if received at first in one stream. When I had stood under the water a little time, I became accustomed to the heat. I then sat down, and the process of douching commenced. The water is made to pass through long jointed tin tubes, which are fixed on the two apertures where the streams enter. Each doucher takes one of these tubes, which he directs to different parts of the body on which the water falls.

"The first morning, the douching continued only five minutes: but the time was increased each succeeding morning till I was able to bear the operation for twenty minutes or half an hour." Mr. Bakewell proceeds to describe, in a very amusing manner, and with graphic truth, the mode in which the porters attached to the baths carried him, rolled up in flannel, more like a corps than a living man, to his bed room; and, leaving upon him the wet sheet in which he was first wrapped by the douchers after the operation, placed him in bed. The effects of the douching are thus described:

"A profuse perspiration immediately succeeds, and generally continues till your attendant comes to release you from your confinement, warm your linen and assist you to dress. Half an hour was considered sufficient in my case; but, for rheumatism or for palsy, the patients sometimes remain in bed three or four hours. The operation is painful and very exhausting: it may be aptly compared to purgatory, when all the peccant humours are to be expelled by the continually modified agency of fire."

Notwithstanding the high temperature in which the douchers remain for so many hours daily during the season, yet they are in excellent health*. The season for douching is from the middle of June till the latter end of September. Before or after that time, it is considered dangerous; the mornings and evenings being generally cold. It is seldom that a patient remains longer than a month at Aix; the operation being too severe to be longer continued without intermission.

I have quoted this passage from Mr. Bakewell's Travels, not merely because the subject of it, in strictness, belongs to our present enquiry, but because Nature, having provided the means of carrying on this operation in a more perfect manner than can be effected by art, has also suggested several circumstances, in the conducting of it, which are overlooked in performing the operation of Douching in this country. In the first place, as those streams of hot water flow into caves or cells in

* One remarkable fact is mentioned by Mr. Bakewell regarding the health of the douchers. "One of them," says he, "told me that he commenced douching at three o'clock in the morning, and should continue till noon." This was a fat old man who had been a doucher for thirty years.

the rocks, the atmosphere of the place in which the operation is performed is imbued with moisture, at the temperature which we must suppose—for Mr. Bakewell has not mentioned it—nearly equal to that of a vapour bath, within the moderate range. This, as it were, prepares the body for the douching, which can be regarded only as a peculiar method of applying percussion in combination with Caloric and water. In the second place, the fall of the column of water being from such a height as to produce a sensation of pain, followed by fatigue, and the benefit resulting from this being so obvious, we ought, in artificial douching, if I may so express myself, to imitate this by percussion with some elastic substance—as, for instance, a ball of cork or caoutchouc affixed on a handle of cane. The pump at Bath is a species of Douche. The temperature of the baths of Aix les Bains is 110°; but this is diminished by the fall of the water in the douching cells. A temperature not exceeding 98°, with percussion, is adequate to fulfil every indication that can be expected from douching*.

c. Solid media.—With regard to the application of Caloric through a solid medium, little requires to be said. It is conveyed by means of salt, bran, bricks, and metallic plates, which are wrapped in flannel or linen, according as the Caloric is required to be slowly or quickly transmitted: and this is regulated, not only by the nature of the conducting medium, but also by the colour retarding or facilitating the radiation of the free Caloric. This mode of applying Caloric is more directly stimulating than any of the other methods; and, is, therefore, more generally resorted to in local affections, such as sudden attacks of a spasmodic kind, either of the heart or of the stomach. When the mere exciting effects of Caloric are required, the solid medium is preferable to that either of air or of any fluid, as it is not followed by perspiration and relaxation.

In the practical application of baths, as therapeutical agents, some cautions are necessary to be attended to.

In the first place, before employing the warm bath, comprehending the *tepid*, in any form, it is essential to recollect that the effects of the *warm bath* and those of the *hot bath* are perfectly different. If a moderate stimulant effect only is required, the *warm bath* may be used for a short space of time; but, if a high degree of excitement be required, then we must have recourse to the *hot bath*. Within the range of from 85° to 106°, we may regulate the stimulus to the necessity of the case: above 108° there is considerable risk; and even at 106° it must be used with much caution; for, when the temperature is

* I have successfully applied my suggestions on this subject to practice; using a cork ball covered with kid leather, and fixed in a whalebone handle to give the blows, whilst the hot water is poured on the part from a height of three or four feet.

so high, if no sweat soon follow, a corrugation of the skin ensues, the perspiration and cooling process are stopped, and the system suffers from accumulated Caloric. When a high temperature, therefore, is required, the vapour-bath should be employed. In deep-seated diseases, the temperature of the bath should be considerably above that which is necessary for relieving superficial affections; but, in this case, topical and partial baths, or fomentations, are preferable to the general bath, as the heat may be carried to the verge of vesication; and the exciting effect may be further augmented by friction and percussion.

If the exciting influence of the bath is intended to be transitory, and to be followed by relaxation, the temperature should not exceed 98°, and the bather should remain in the water more than half an hour. To secure the sudorific effect, the same temperature should be employed, and kept up during the continuance of the patient in the bath, which should be extended until nausea supervene. He is then to be removed and placed between blankets in bed, and the flow of sweat encouraged by tepid diluents. To secure the tonic effects, the same temperature may be employed; but the patient should not remain in the bath beyond fifteen minutes; and brisk exercise should be taken immediately afterwards; or, if he be too weak to take exercise, friction should be applied to the whole surface of the body. That modification of friction which is called shampooing, an Hindostanee practice, is perhaps the most beneficial.

In the second place, previous to the use of the warm and hot baths, we must attend to the condition of the system. Hot baths are apt to bring on violent headache: hence they are more hurtful to full, gross habits, in plethora, and those predisposed to apoplexy. If warm bathing be necessary for such persons, previous depletion must be resorted to. The temperature of the bath, also, should be at first under 98°, and gradually increased. But in persons of an opposite diathesis, if a hot bath be necessary, the highest temperature may be employed at first, and the person should remain only a short time in the water, that its stimulant influence alone may be obtained.

The opinion that the warm bath is invariably debilitating, is of very ancient date. By the Greeks they were regarded as productive of effeminacy; and, in the Clouds of Aristophanes, young men are warned to abstain from their use*. But the modern opinion, to this effect, has arisen from the careless and indiscriminate use of it. According to Markard, a high authority on the subject of baths, the warm bath is tonic when the temperature does not exceed 90°. At Piedmont, during sixteen years, he saw many debilitated individuals restored to strength

* Βαλανείων ἀπέχεσθαι, l. 978.

and health by baths of this temperature; and, during their use, the bathers always remarked that they felt stronger on the day of using the bath. He relates the case of a lady, who for three years was unable to turn in bed: she employed the warm bath every second day; and, in three months, was perfectly restored both to health and strength. As far as my own experience enables me to judge, I am inclined to extend the temperature to 96°; under which I have generally observed that baths debilitate rather than invigorate the system. Indeed, Markard himself does not deny that the effects are sometimes debilitating at 90°; but he ascribes them to the state of the nervous system.

Persons of a sanguine and melancholy temperament agree better with warm bathing than those of opposite temperaments. In the melancholic it is supposed that the warm bath acts by diminishing the rigidity of the muscular fibres, which are supposed to be greater than usual in those of this temperament. It is scarcely requisite for me to say that this statement of the condition of the muscular fibres in these temperaments is erroneous; and that the effect arises from the impression made on the nervous system, and the sympathetic respondence of the whole frame with the state of the skin.

Children sustain warm bathing better than adults; baths of a moderate temperature are, therefore, much and successfully employed in their febrile affections. In adult age, women bear warm bathing worse than men; a circumstance depending chiefly on the greater irritability and sensibility of their systems. In the state of pregnancy, we are cautioned against ordering the use of the warm bath: but, as little attention is paid to this circumstance in Russia, where the bath is used as a luxury, the necessity of this caution may be doubted.

It was customary with the ancients to anoint the body immediately on coming out of the bath: too rapid evaporation was thus prevented: and the same custom is still employed by the inhabitants of Asia within the tropics. It is not less useful in cold climates, for preventing the too rapid abstraction of Caloric from the surface. Indeed, the practice is merely following Nature, who has given to the inhabitants of warm climates a perspirable matter more unctuous than that which she has bestowed on the inhabitants of colder countries. Anointing the body was anciently a part of the discipline of the bath; and we find that the Unguentarius was one of the principal officers attached to the public baths of the Greeks and the Romans*. Old or long-kept oil was chosen for the purpose of anointing bathers; and it was rendered saponaceous by an admixture of

* De balnies omnia quæ extant apud Græcos, Latinos et Arabes, &c. Venet. 1585. Luther de balneis veterum cum inunctione conjugendis. Erford, 1771.

an alkali and vinegar. "Unctioni," says Celsus, "vero aptissimum est vetus oleum, vel nitrum, aceto et oleo admixtum." When the bather was in a delicate state of habit, the body was anointed, and again immersed in the bath. Indeed, anointing the body was employed under many circumstances by the ancients: thus, Celsus says, justly, that it is improper to use the warm bath, in a valetudinary state of the habit, if the temples feel as if bound and the skin be dry; "the bather must," continues he, "be gently anointed, and by all means avoid cold, and be abstemious."

Many accidents occur in Russia from using the warm bath after a full meal; at which time it impedes digestion, and favours determination to the head. If we refer to the custom of the ancients, whose principal meal was supper, and was taken at sunset, we find that they performed all their violent exercises, and bathed an hour before supper. If it be injurious to use the warm bath with a full stomach, I should say that noon is the best period for employing the warm bath. When it is improperly used, it relaxes the frame of body, debilitates generally, causes syncope, hæmorrhages, and dyspepsia; and, therefore, when any of these occur, the use of the bath should be immediately discontinued.

The warm bath is beneficially employed for the cure of diseases. In febrile affections, it has been employed from time immemorial, both to prevent their accession and to mitigate their symptoms. In intermittent fever, it has been used before the accession of the paroxysm. As far as regards the practice of the ancients, Celsus lays down the most ample directions in the 17th chapter of his second book "De Medicina;" and, setting aside the false theories of the fathers of the healing art, many of their ideas upon the subject of warm bathing in fever are excellent. They usually employed the bath during the intermission, rarely during the continuance of the paroxysm. Their cautions upon this point are so correct, that I will translate the words of Celsus: "The warm bath," he says, "may be employed, provided, however, that the præcordia be not hard nor swelled, nor the tongue rough, nor any pain be felt either in the trunk of the body or in the head; and that the fever be not then increasing." If the warm bath be used immediately before the febrile accession, it operates by determining to the surface, and obviating that state of the extreme vessels which always attends the cold stage. In countries where the warm bath is much used, it is supposed to prevent the accession altogether. During the hot stage of fever, the effusion of tepid or even cold water is preferable to immersion of the body in warm water; it more rapidly diminishes the heat of the surface, and, consequently, the force of the heart and arterial system. In those cases, also, of inter-

mittents, in which there is a great determination to the lungs, the tepid bath, at a temperature of 90°, is most advantageously used.

In typhus, the warm bath is employed to allay morbid irritation, and procure sleep. In those countries where it is much used, it is found to alleviate all the symptoms; and, in a special manner, to counteract the great determination to the head. If we employ it with a view of causing perspiration, it will prove most beneficial at the time that the skin is hot and dry, and the temperature increased. The general warm bath is little employed in this country, in continued fever: the local baths, especially the pediluvium, are more resorted to; and, certainly, by the revulsion which they induce, they arrest that determination to the head which brings on delirium. When this is to be obtained, the temperature should be as high as it can be borne: it should even redden the legs; for, unless this be effected, its counter-irritant influence will be very feeble. In the commencement of fever, if the general bath be used, the temperature should not exceed 98°, and the patient should remain for, at least, half an hour in the bath: in the advanced stages, after debility has supervened, the heat of the bath should not be under 102°; but the time of remaining in it should be short, and never should exceed the period when the stimulant effect begins to subside. If the pediluvium only be employed, and the fever have run on for some time, it must be used hot for a very short period, and the patient must not be in the erect position; as this, at any advanced period of the disease, is apt to induce syncope. Dr. Currie employed the warm bath freely in continued fevers, if they were not contagious, especially when they were accompanied with affections of the lungs; and his practice was more successful in these diseases than most men can boast of. This form of bath is also highly useful in hectic, when the heat rises during the paroxysm; and a hot feeling is experienced in the palms of the hands and in the soles of the feet.

In many of those diseases which consist of the inflammation of some particular part, accompanied with general febrile action, the warm bath has been much resorted to. In external inflammations, it is often preferable to topical fomentations: easing the pain, lessening the swelling, and allaying irritation. It is most useful, also, in the passage of gall-stones of a large size, in that of urinary calculi, and in every instance of painful constriction in any internal cavity. The topical application of warm bathing, particularly in fomentations, is well adapted for these diseases: but, in general, no directions are given regarding their application, which is left altogether to the nurse; consequently they are seldom properly used.

The warm bath should never be employed in the early stage of mania, at which period, indeed, no temperature exceeding

that of the body can be used with impunity. Instead of being refreshed by the bath, of a temperature higher than that of the body, the patient becomes languid; rigors ensue, followed by the dry heat of the skin: restlessness, and often wild delirium. It is in the convalescent stage of the disease in which any advantage can be expected from warm bathing; it then excites the secretory organs, particularly the liver, to healthful action; it diminishes and dissipates the peculiarly offensive fœtor which maniacs always exhale, and re-establishes the cuticular function. The temperature of the bath, for this purpose, should not exceed 98°, and the patient should not continue in it longer than twenty minutes. If any turgescence of countenance or confusion of ideas supervene, a napkin, wrung out of cold vinegar and water, should be wrapped round the head, and the use of the bath should be suspended.

In every species of Cynanché, or sore throat, warm bathing has been found useful; but more especially in croup, Cynanché *trachealis*, a disease very common to children in some places of this island exposed to north-easterly winds. This disease varies in its symptoms: there is, however, generally spasmodic affection of the muscles of the upper part of the trachea, and a strong inflammatory action in the lining membrane of this air tube. The warm bath is applicable for the mitigation of both these symptoms: it diminishes the febrile action; allays the topical inflammation; and, as the warm vapour is also inhaled during its employment, it takes off the tension of the trachea, and checks the formation of the adventitious membrane, which is the most dangerous part of the disease. In children, indeed, as I have already stated, the warm bath exerts a more decidedly beneficial influence than in adults. When the warm bath produces its salutary effects in children, it is always followed by an easy, tranquil, and profound sleep.

In no diseases so particularly as in rheumatism, whether acute or chronic, is the warm bath a remedy of great power. In the acute species, however, the phlogistic diathesis must first be relieved by large doses of calomel, tartar emetic, opium, colchium, and purgatives; or, if requisite, by bleeding. The bath may be applied either generally or topically, according to the nature of the attack, in the form of vapour, or that of water. The temperature of the general bath should not exceed 98°; and the patient should remain in it more than twenty-five minutes, or until a feeling of approaching syncope supervene. On rising out of the bath, he should be placed in a bed with blankets only, both because they are bad conductors, and because it is requisite to keep up the perspiration for some hours: when sweating is not excited, the use of the bath increases the severity of the disease. The sweating, when commenced, should be maintained for six or eight hours; for, although sweating be one of the

symptoms of rheumatism, it does not prevent the necessity of artificial sweating. In the chronic form of the disease, the bath may be hotter; for, as it is a disease of debility, the patient cannot bear to be severely sweated. After the stimulant effect of the warm bath, as a counter-irritant, it may be advantageously employed as a tonic, at a temperature of 96° to 98°, the patient remaining in it for a short time only; and taking brisk exercise immediately after coming out of the bath.

In small-pox, the warm bath has been used from the earliest periods of recorded facts. In Hungary, Markard relates, that when a person falls sick of small-pox, he is immediately put into the bath, then wrapped in warm linen and put to bed, where he is sweated; and this treatment is repeated several times, until the pustules appear. While these are out, the use of the bath is discontinued. Dr. Fisher states, that so successful is this treatment, that, in 1727, in a very fatal epidemic of small-pox, no child died in the villages and towns where the bath was used. In the writings of De Haen, many successful histories of this treatment are related. In one district in Russia, 116,000 persons were seized with natural small-pox in one year: the greater part used the warm vapour bath, and such was its beneficial effect, that not more than twenty-five of the whole number died.

In catarrh, when the cold applied to the surface produces a determination to the lungs and a febrile state of the system, with a dry constricted state of the vessels of the surface, sweating produces a crisis and obtains relief; and warmth to the whole surface is peculiarly useful and agreeable. In such cases, the use of the warm bath is too often neglected; and even the pediluvium, which is more commonly employed, is used in a manner seldom or never efficacious.

In dysentery there is a determination to the intestines, and, whilst the disease proceeds, the surface becomes dry and harsh. One of the principal objects, therefore, of the practitioner is to equalize the circulation and determine to the surface. For this purpose, nothing answers better than the warm bath, for promoting the cuticular action, and consequently relieving the intestines: and many proofs of its efficacy from the practice of army physicians—for instance, that of Sir J. Pringle, Sir George Baker, Dr. Rollo, Sir G. Blane, Dr. Dewar, and others—might be brought forward. The temperature of the bath should not exceed 98°; and the patient should remain in it for a considerable time. It is best adapted to the second stage of the disease, after proper evacuations have been procured and the febrile excitement diminished. Warm bathing is equally well adapted for the relief of colic and spasmodic obstructions: and not less so for those affections that depend on some directly sedative or paralyzing cause, such as the poison of lead.

In spasmodic and convulsive affections, the warm bath is one of the best remedies we can employ. Tetanus, in particular, has been benefited by its use. In South Carolina, Dr. Chambers trusted altogether to opium and the warm bath. If the pulse was very frequent, and the heat of surface great, he used the bath at 96°; but if the pulse was not much affected, and the temperature of the skin moderate, he then raised the heat to 102°, and kept his patient in the bath until the pulse became full and soft; and, on taking him out of it, he administered opium every half-hour. Dr. Girdlestone employed the warm bath in the same manner in India. When the disease arises from cold, or alternations of temperature, this plan will prove successful: but, in traumatic tetanus, dry cupping should be employed along the course of the spine, alternately with the hot bath at 102°.

In dropsy, warm baths, both natural and artificial, have been long employed, and found to aid the removal of the effused fluid: but it must be remarked, that, if the warm bath does not soon cure, it is likely to increase this disease.

In diabetes, the warm bath has been found a useful addition to other means, acting as a counter-irritant, in subduing the irritation, both local and general, which is often so conspicuous, and in aiding the influence of narcotics.

Finally, in no class of diseases is warm bathing more beneficial than in some forms of Dyspepsia; more especially those in which there exists some fixed or local visceral irritation, and a dry unhealthy state of skin, arising from an irregular distribution of the blood. The warm bath in such cases operates both as a soothing agent, and a derivative to the surface, aiding greatly in restoring the due balance of the circulation. Upon the whole, the influence of Caloric as an Excitant, when properly employed, is such as to merit the confidence of the physician*.

MECHANICAL INFLUENCES.

The influences of this description which operate as excitants are *friction* and *percussion*: the first operates both topically and generally, the second only topically: both decidedly rouse the energy of the capillary system, and aid effectually in removing congestions and morbid depositions.

* For further information on this subject, the student may consult the work of Markard, "On the Use and Abuse of Baths," published in German in 1773: those who are unacquainted with that language will find a valuable abstract of it in Dr. Beddoes' work on Consumption: much useful information is also contained in Saunders' Treatise on Mineral Waters; Falconer on the Dietetical and Medical Use of Warm Bathing; Reid on Warm and Cold Bathing; Cameron on the baths of the Romans. Lond. 1772; and Stix—de Russorun balniis calidis ac frigidis—Dorpat, 1802.

a. Friction may be *immediate* or *mediate.*—*Immediate* Friction is performed by the action of the hand alone, dipped in flour, to prevent abrasion: the movement should be brisk and the points of the fingers rather than the palm of the hand employed. In a few seconds the surface becomes red and warm; a sensation of tingling is felt beyond the excited part; and, if the friction be continued for a considerable time, and daily repeated, swellings gradually disappear under its influence, and parts which had become rigid or immoveable, are relaxed and regain their mobility. Many cases of the beneficial influence of immediate friction, in white swelling of the knee, and other scrofulous tumors, which were treated by Mr. Grosvenor of Oxford, strikingly demonstrated the advantages to be derived from it, as an excitant of the capillary system. Immediate friction is best adapted for local affections. It may be questioned whether the benefit is solely referable to the mechanical excitement, or whether something is not due to the electricity likely to be developed by the friction? But this is a question which I am not prepared to answer.

Mediate Friction is performed by the aid either of the flesh brush or hair gloves, or of various oils and liniments. The advantages of general, mediate friction in preserving health, by promoting the action of the skin, was so early known in reference to horses, and the operation of daily currying regarded so essential, that it is wonderful it was not sooner employed, both as a prophylactic and as a therapeutical agent, in man. It determines to the surface, promotes the cuticular functions, favours the balance of the circulation, and invigorates the general powers of the habit. The advantages of it have lately been fully ascertained; and the daily use of the hair gloves has become almost general. Shampooing is a modification of general friction, and it may be placed under this form of it, as oils of various kinds are employed; but, although much confidence is reposed in these applications, yet it is to the influence of the friction that any benefit obtained from shampooing is to be attributed. The best time for employing mediate friction is the morning, directly after getting out of bed; and the benefit of it is much enhanced by the use of the shower bath after the operation.

b. Percussion is merely an extended degree of friction, or, at least, it operates beneficially on the same principles, namely, by promoting circulation in the capillaries of the affected parts. Percussion, however, has the advantage of influencing deeper seated vessels than can be affected by friction: under its influence, both swelling and the redness disappear. It has one advantage over the application of cold and other means of constringing, as it were, these vessels and enabling them to carry forward their contents; it does not cause metastasis, or a trans-

ference of the inflammatory action to other, and often more important, organs. If congestion be the chief cause of the pain in gout and rheumatism, and in other tumors, nothing is more likely to remove this than by giving a fresh impulse to the overcharged capillaries: and nothing is so capable of promoting this as percussion.


a
b

The best mode of employing Percussion is by means of a Caoutchouc or Indian rubber bottle, *b*, affixed to a flexible handle, *a*, either of cane or of whalebone, and stuffed with cotton. This gives a sharp blow without the bruising, which is always more or less the result of employing a solid hammer, or similar instrument. The action of Percussion, when it is accompanied by pouring warm water on the affected part, closely resembles that of the natural Douche baths of Aix, in Savoy, that have been already described. In cases of chronic Rheumatism, and of *Nodosity of the joints*, the beneficial influence of Percussion has been well ascertained. Like exercise, it tends in such cases to renew the circulation, to promote absorption, and to restore the lost flexibility of the diseased joints. As an adjunct to blistering, or rather in the intervals of their application, Percussion and Shampooing are of the greatest benefit; the intention being to promote a free circulation in diseased joints; to co-operate with the constitutional treatment requisite to improve the general health. Pumping, douching, and shampooing, operate exactly in the same manner; and can only be regarded as modifications of Percussion; and all as varieties of passive exercise.

MENTAL INFLUENCES.

The influence of mind upon matter, both as a cause of morbid changes in the body, functional and organic, and as a therapeutical agent, has been too much overlooked in the investigation and the treatment of disease. Who has not felt in his own person the influence of mind,— of a passing recollection,—the return of a melancholy thought, in working such a change upon the functions of the body, as, almost at once, to transmute health into positive disease. Among the phenomena which result from the influence of the mind on our corporeal frame, is change of temperature: one passion causes augmented heat, another a sensation of intense cold. The mind, in this case, operates on the sanguiferous system, through the agency of the brain and the nerves. It operates according to the nature of the impression; whether that be of a depressing or an excitant description. Grief and sorrow almost arrest the circulation, a chill spreads over the skin, the blood forsakes the cheeks, a tremor seizes upon

the limbs; and the impression may be followed by a long series of functional ailments and bodily suffering. On the other hand, eager hopes or joyful anticipations, arousing the energies of the nervous system, and consequently operating as salutary stimulants, augment the force and celerity of the pulse; and, within certain limits, the effects are salutary. It is with the latter that we are, at present, to be occupied.

All the pleasurable emotions, besides accelerating the circulation, elevate the animal temperature; the pulse beats quick, the eyes glisten, and the face glows, whilst the respiration is accelerated: hence we have every reason for supposing that the affections of the mind of this description act upon the brain and nervous centres in the same manner as physical excitants. Their influence, also, may be carried to such an extent as to produce more or less permanent changes in these centres; and, when carried beyond a certain limit, it may exhaust their excitability so completely as to prove highly dangerous. Like physical remedial agents, therefore, mental influences, when misapplied, may prove destructive.

The exciting passions differ from each other in intensity;—they also differ in some other respects; consequently, they require to be separately examined.

Any simple pleasurable feeling—self satisfaction, the exercise of imagination, admiration, esteem, gratitude,—operate as direct stimulants to the nerves, and thence to the sanguiferous and muscular systems; but the increase of action which they induce is moderate in degree, and may be continued for a considerable length of time, not only without producing exhaustion, but with the utmost benefit to the system; diffusing equably the circulating fluid; aiding absorption, secretion, and excretion; and so favouring assimilation as to increase the healthy action and the natural vigour of every important organ. These emotions, therefore, in the strictest meaning of the term, may be regarded rather as Tonics than as Excitants. Those, on the contrary, that produce a sudden action, which terminates in exhaustion if long continued, namely *Joy*, *Hope*, and *Impetuosity*, are Excitants.

a. Joy produces effects closely resembling those which follow a powerful, material, direct Excitant; the action of the heart and arteries is suddenly augmented to such a degree that palpitation sometimes ensues; whilst, as might be expected, the animal heat and the perspiration are considerably increased; more blood is consequently sent through the capillaries; the face glows, the eyes sparkle, and are sometimes suffused with tears; whilst the breathing becomes fuller and quicker than usual, and the muscular vigour is increased. The liver, the pancreas, and the absorbent system, share the impulse. The mental functions of the brain are not less excited than those of the body; the imagination takes a more excursive range; the most pleasurable

of the past scenes of life are again pictured in the mind, the future teems with only gay and delightful anticipations; every task seems easy, every labour light, and schemes and undertakings the most momentous and difficult appear already accomplished and crowned with the most brilliant success. But, besides these illusive impressions, the excitement of Joy quickens the senses, the eyes are turned with celerity towards every object, which is instantly and clearly perceived; the ear is alive to every sound; the taste and the touch are acutely sensitive; and every bodily action is more prompt and energetic.

It is not my intention to offer even a conjecture respecting the metaphysical nature of this powerful Excitant; it is sufficient for us to know that Joy operates as an Excitant.

The states of the habit in which Joy is most likely to display, very obviously, its exciting influence, are those of diminished action in diseases, particularly those of a chronic character, in which languor and debility exist; such as Melancholia, Hypochondriasis, Dyspepsia, and Chlorosis. Alexander Trallianus has recorded a case of Melancholia cured by Joy.* It is not easy to say in what manner it can be applied as a therapeutical Excitant, except in the communication of good news to the afflicted: but could it be administered with a proper regard to time and quantity, it is well adapted for aiding in relieving the morbid conditions of the body just referred to, and likely to be productive of highly beneficial effects: many cases, were it necessary, might be detailed in proof of the accuracy of this assertion†.

But as Joy, like every direct Excitant to the nervous and irritable fibre, exhausts the nervous power on which the functions of the vital solids depend, so, as I have already hinted, excessive Joy is an injurious agent, and may cause temporary delirium and epilepsy‡. This is particularly the case where Joy acts on persons suffering under grief or any other depressing passion; for, in such a state, the irritability being, as it were, accumulated in the body, the susceptibility of impression is greatly augmented; and, consequently, for the same reason as the application of much heat to a frost-bitten limb, it is followed by gangrene and the death of the part: sudden transitions from grief to extreme Joy are at all times hazardous, and often prove mortal. The fatal influence of this Mental Excitant, in these cases, is like the blaze of an electric corruscation: the instant it has passed, the extent of its depredations are exposed; whilst it illuminates, it consumes its victim. Besides, the instances described by classical writers§,

* Opera, lib. xli, p. 17.

† Lory de Melancholia, t. i, p. 57. Hildanus' Obs. Med. Chir. c. 1. Ob. 79. Etmuller, Opera t. ii. p. 295.

‡ Van Sweiten, Comment. t. iii, p. 414. Boerhaave, de morbis nervorum, lib. ix. cap. 12.

§ Livy, lib. xxii. Valerius Maximus, lib. ix. cap. 12.

several well-authenticated cases of this kind, more fitted for our consultation, are collected in Haller's Physiology (vol. v, p. 581). I may mention here one instance illustrative of the effects of sudden joy, as it occurred in the history of our own country. In the year 1542, after the execution of Queen Katharine Howard and lady Rochford, the innocence of Arthur Plantagenet, Viscount Lisle, the illegitimate son of Edward the Fourth, who had been removed from the governorship of Calais, and committed to the Tower, on suspicion of being privy to a plot for surrendering that town to the French, being established, the King, Henry the Eighth, sent to him his secretary, Sir Thomas Wriotesly, with a ring as a token of his favour. The message was delivered with much eloquence and feeling, and caused such an excess of Joy, that it threw Lord Lisle into convulsion, which quickly terminated his life*. The necessity, therefore, of caution in the employment of so powerful an Excitant, scarcely requires to be mentioned.

b. Hope is a modification of Joy, arising from the prospect of some future good. When it is misdirected and awakens unreasonable anticipations, it lays the foundation of the most serious shocks to the mental as well as the physical system of man; the excitability of the sentient principle is morbidly augmented; and a tendency to delirium induced, which often lays the foundation of Insanity. In moderation, however, Hope acts as a salutary excitant to the nervous and irritable fibre, it sustains the body under the depressing influence of disease, and not unfrequently effects cures, the merit of which are erroneously ascribed to the physicians. It is a more manageable curative agent than Joy; and one which should never be lost sight of in the treatment of disease.

c. Impetuosity—under which term I rank *enthusiasm, anger*, and other violent affections—reacts upon the brain and nervous system nearly in the same manner, and with equal energy, as extreme Joy. It is, however, a voluntary act, although it often occurs without deliberation—I may almost say without consciousness. It is placed in the table of Excitants rather to afford an opportunity of pointing out, to the student and the inexperienced practitioner, the necessity of guarding the debilitated from indulging in it, than to point out its use as a remedial agent. The suddenness and fatal force of its impression are well illustrated by the following case, which came within my own observation. A gentleman, in the advanced stage of phthisis, was visited by an old friend, whom he had not seen for many years; the conversation turned upon an event in which the poor invalid felt deeply interested: in relating it, he became greatly excited, rose from his seat, and displayed an unusual impetuosity of

* Hollinshed, quoted in Bayley's Hist. of the Tower, vol. i, p. 74.

manner: but he had scarcely concluded the narrative, ere he sunk into his chair and instantly expired. It is easy to conceive that, in such a state of eager excitement, the effects are likely to be more strikingly obvious upon the thoracic viscera than any other set of organs; even in a state of health, it causes an unusual glow of warmth in the præcordia, the pulse beats quick, and a peculiar sensation is felt, which is referred to the heart. When impetuosity rises to anger, the muscular system is preternaturally excited; the face is flushed; the breathing irregular and convulsed, and thence apoplexy sometimes follows: or epilepsy, hæmorrhagies, hepatic diseases, or insanity, may result. It is, nevertheless, true that palsy has been suddenly cured by a fit of anger.

THERAPEUTICAL EMPLOYMENT OF EXCITANTS.

In the Class of Excitants, we have seen that the number of agents, natural and artificial, that may be therapeutically employed is considerable. When they are grouped together in accordance with their active principles, they consist of *volatile oils*, combined and uncombined; *Camphor*; combined *acrid fixed oils*; *Balsam*; *some Alkaloids*; *Alcohol*; and *Ether*; *Oxygen*; *Chlorine*; *Iodine*; *Bromine*; *Phosphorus*; *Common salt*; preparations of *Gold* and of *Mercury*; *Ammonia*; *Electricity*; *Caloric*; *mechanical impulses*, and the *exhilarating Passions*.

In prescribing any of these material agents, or in taking advantage of the mental affections in this collection of Excitants, the general intention of the physician is to *sustain* the powers of life under diseased conditions of the frame; to *rouse* action when it is defective; and, finally, to imitate nature in setting up *temporary movements* in the system, resembling disease, or what has been termed *reaction*, in order to restore the balance of the circulation, and that equilibrium of all the functions which constitute health. We have now, therefore, to examine in what manner these intentions are to be fulfilled, as far as respects this class of medicinal agents.

The first of these groups, *volatile oils*, whether combined in *barks*, *roots*, *seeds*, or other parts of vegetable bodies, or separated from these by process of art, are excitants of considerable value. They all operate powerfully on the surfaces with which they are placed in contact, whether they are applied externally, or are introduced into the stomach: but their influence is not confined to these surfaces; it is soon extended over the body, both by nervous communication and by the medium of the circulation. They can generally be detected in some of the secretions, more especially in the urine and the perspiration. Thence the primary influence of volatile oils is exerted on the coats of the

stomach and the rest of the alimentary canal, when they are taken internally; and their secondary influence is on the cerebral and rachidien centres, and the capillary system. Externally applied, the volatile oils operate by stimulating, powerfully, the vessels of the skin: when undiluted, they excite inflammation, and produce particular eruptions on the portions of the surface on which they are rubbed.

In taking advantage of the excitant effects of *Volatile Oil*, in affections of the digestive organs, the condition of the stomach and ailmentary canal must be correctly ascertained: for under the term *dyspepsia* is comprehended every irregularity in the functions of these organs, often arising from the most opposite causes: and it is of the utmost importance to discriminate between that pain which is the result of spasm or simple irritation, and that arising from subacute inflammatory action, which not unfrequently occurs in dyspeptic affections. In reference to the stomach, it is in *atonic* Dyspepsia, especially when it has established itself as a chronic affection, that the volatile oils, and the aromatic barks, roots, flowers, and fruits containing them, may be most advantageously prescribed. This affection is characterized by distension of the organ after eating: and by flatulence when the stomach is empty. It is at first relieved, but afterwards increased, by taking food. The other symptoms are eructations, sometimes acid, at other times putrescent; a pale and bloated face; torpidity of the bowels, or diarrhœa of crude but liquid undigested food, the expulsion of which affords temporary relief to the uneasy tension of the abdomen, which always, more or less, is present; it is also occasionally attended with nausea and even vomiting; or by perspiration occurring on the slightest exertion. Besides these symptoms, others indicative of general deficient action supervene; namely, coldness of the extremities, emaciation, weakness, faintness, tremblings, and vertigo; not unfrequently noise in the ears, and palpitation of the heart; a morbid sensibility to every change of weather; and a disposition to sink into a state of apathy and indifference, and a diminished power both of attention and memory. Under such circumstances, not only the whole process of nutrition languishes, but the stomach loses the stimulus of demand, and falls into a state of complete inactivity. In this condition, the uncombined volatile oils and also the aromatics, of which they are the efficient principles, are admirably calculated to relieve some of the most urgent symptoms; although the physician would ill perform his duty who would rely upon them for obtaining a permanent cure. In the flatulence of atonic dyspepsia, they afford most relief when they are combined with purgatives: unless the patient be of advanced age, in which case, as the stomach is sometimes so distended as to lose its contractile power, and

convulsions and even apoplexy are apt to ensue, a more immediate stimulant is demanded; thence, the best adjunct to the volatile oils, in that case, is Ammonia. The uncombined oils are preferable to the combined in such cases; and the best form of administering them is that of an *oleo-saccharum*, with which the Ammonia readily combines: the Camphor mixture may be the vehicle. Thus, a mixture consisting of fʒss of Oil of Caraway, ʒi of Sugar, ʒiii of Carbonate of Ammonia, and f℥vi of Camphor mixture, may be taken in doses of a table spoonful, frequently repeated, with much advantage.

It is not more important, however, in administering these aromatics in this form of indigestion, to discriminate between it and that form of the disease which depends on subacute inflammation, than to ascertain that it is not grafted upon a hypochondriacal condition of the habit, in which case the uncombined oils ought *not* to be employed. In some other affections of the intestinal canal, as, for example, *colic, cholera*, and *atonic gout* attacking the stomach, as no inflammation is suspected in these cases, the warmest of the uncombined oils—namely, those of Cloves and of Cinnamon may be administered, even during the utmost violence of the pain. In making this statement, however, it is essential to guard against continuing the use of these excitants, even in a greatly diluted form, after the paroxysm which they are intended to mitigate has subsided: during its continuance, when the spasm is intense, and there is great prostration of strength, the strongest excitants are required; but immediately afterwards, the alimentary canal should be relieved from the mucous accumulations which always accompany the attack, by large doses of Calomel, Ipecacuanha, and Colocynth, and mild aperients should be substituted for the Volatile Oils or the aromatics.

In Asiatic Cholera, in the second period of the disease, when the pulse is scarcely perceptible at the wrist; when the surface is moist and cold, and the voice merely a mingled huskiness and feeble whisper; when there is oppression and weight at the præcordia, and the insensibility of the stomach is so great, that it is not more conscious of the most powerful excitants than if it were a lifeless pouch, these oils have been strongly recommended; but the pathology of the disease is still too obscure to enable us to decide on the propriety of their employment. In general atony of the intestinal canal, however, causing either obstinate costiveness or passive diarrhœa, the addition of aromatics, especially the uncombined volatile oils, to warm purgatives in the one case and astringents in the other, by rousing the nervous energy, is generally productive of the most beneficial results. Any of the oils may be ordered; but if any selection is made, the Oil of Turpentine appears the best adapted to fulful

the indications in view. It may be combined with large doses of Carbonate of Ammonia; and it may itself be given in doses of from ʒii to half a fluid ounce. It aids in rousing the system, whilst, at the same time, it assists Calomel in lessening the irritability of the stomach. In the first instance, the volatile oil merely operates as a topical stimulant to the stomach; but when its vitality is awakened, it is then taken into the circulation, and acts as a general excitant. It has the advantage of some other of the group to which it belongs, by its peculiar determination to the kidneys, the function of which is always suspended in this and similar diseases.

In whatever form of gastric or intestinal disease these aromatics seem to be indicated, it is of vital importance to ascertain the exact condition of the abdominal viscera. We should be satisfied that neither ulceration nor scirrhus exist in any portion of the alimentary canal: and, if vomiting and spasm be present, that these are not symptomatic of cerebral congestion, nor irritation, either of the brain, or of the cerebellum, or of the spinal cord. The condition of the liver, the pancreas, and the spleen, should be inquired into, as nothing is more deleterious than the administration of the Volatile Oils in diseased states of these viscera depending on increased vascular action. When the tongue is red and glazed, denoting subacute inflammation of the villous coat of the stomach, a not unfrequent cause of one form of Dyspepsia, it is scarcely necessary to caution against prescribing these aromatics.

In *chronic rheumatism*, when it assumes the true asthenic character, or what has been significantly denominated *cold* rheumatism, the *arthrodynia* of Dr. Cullen, the principal remedies upon which we can rely are the Volatile Oils, particularly the *Cajuputi oil* and the *Oil* of *Turpentine*. If there be no plethora nor febrile state present, these oils may be administered with safety: but should any circumstances intervene to demand either local or general blood-letting and the aid of mercury, then the use of the Volatile Oils should be either discontinued, or their operation should be very closely watched.

In some of the varieties of *Epilepsy*, especially that one which has been denominated maniacal Epilepsy, the beneficial influence of Oil of Turpentine, in large doses, has been well ascertained. In such cases, the excitant effect of the oil on the mucous membrane, operating as a counter-irritant, seems to be the source of the benefit which it produces. It is usually administered in doses of fʒvi, at intervals of six hours: it generally purges; but, when this does not happen, its beneficial influence is aided by the addition of Castor oil, or the occasional administration of a cathartic, in conjunction with it.

In looking at the peculiar determination to particular organs produced by some of the combined oils, we are enabled to take

advantage of these, by selecting the substances containing them, for the relief of particular symptoms, when the general condition of the system does not contraindicate the employment of Excitants. Thus, in depressed states of the habit, when the circulation is languid; when the skin is harsh and dry; or in pustular eruptive fevers, as, for example, confluent small pox, when the eruption suddenly recedes; or in protracted intermittents, especially when these are combined with cough; Serpentaria is admirably adapted to fulfil every intention. In this root, the volatile oil is combined with bitter extractive, and both are taken up by the proof spirit in making the tincture. When administered in this form, which is the best, in doses of fʒi to fʒii, if the surface be kept warm, the cutaneous capillaries are powerfully affected, and, at the same time, whilst diaphoresis is promoted, the bitter extractive is operating as a tonic and supports and supplies energy to the general system.

In stating that the cutaneous capillaries are powerfully affected, this remark might be supposed to imply that these minute vessels may be excited to action, independent of the power of the heart; but that is denied. There are certainly, I again repeat, no direct experiments, nor observations, to prove that there is any contractile power in the capillaries themselves; thence any increased flow through them may imply an increase either in the force or the frequency of the action of the heart; but, as I have said before, there is reason for believing that these vessels are specially acted upon by Excitants.

All the aromatic Excitants are excellent additions to tonics, when they are judiciously prescribed: indeed, many of the aromatics in this group of Excitants are combinations of tonics and stimulants; as, for example, the rhizome of Acorus *Calamus; Winter's bark;* and Canella *alba:* but there is much more advantage by forming artificial combinations of Excitants which we can readily bring together, than in those which Nature furnishes. In the artificial combination, the proportion of the Excitant, or of the Tonic, may predominate, according to the object intended to be accomplished by the compound. In such combinations, also, the active principles of the drugs only are combined; and they can thus be administered unincumbered with the less active substances contained in the vegetable aromatics. Many of the aromatics in ther natural state cannot be combined with the salts of Quina and Cinchonia, or with Salicina, and some other alkaloids, without suffering decomposition; such, for example, are Cinnamon, Cloves, and Pimenta, on account of their precipitating the Quina, and most other alkaloids, in the form of inert tannates; whereas the volatile oils of these plants, in the form of *oleo-sacchara*, may be combined with almost every other substance without undergoing any change. Indeed, it is remarkable that the aromatics,

which derive their properties solely from the volatile oil which they contain, are not altogether administered in the form of their oils.

There can be no doubt that *Camphor*, which forms a group by itself, although it has so close an affinity to the volatile oils, is properly placed in this class of medicinal agents. Its excitant properties are confirmed by its influence in stimulating the uterus to renewed action, when its efforts have been suspended, during parturition, by the influence of opium, or by hæmorrhages, or any other cause: a purpose for which it has long been successfully employed by Dr. Hamilton, the Professor of Midwifery in the University of Edinburgh. A diversity of opinion, however, exists respecting the stimulant property of Camphor. In examining the question, the first indication which we obtain of its stimulant property is the warmth which is felt in the throat and at the epigastrium, when it is swallowed in moderate doses. This sometimes continues for several hours. Its impression on the gastric nerves is propagated to the brain, the spinal cord, and the whole ganglionic system. During this time, the heart contracts less vigorously, the pulse is consequently diminished in frequency, is small, and unequal: the heat on the surface of the body is diminished, rigors sometimes occur, and spread over the limbs; respiration proceeds more slowly: and vertigo, and a kind of inebriety, pandiculations, and disordered vision supervene. In a short time, however, these symptoms of a sedative character are succeeded by a secondary effort, undoubtedly one of increased action. The Camphor, which in this case must be given in small doses, seems to be carried into the circulation, and is directly applied to all the organic tissues. About an hour after a large dose of Camphor has been swallowed, the pulse rises in strength, become frequent and vibrating; the temperature is elevated; the eyes glisten; the skin is dry; there is now much headache, some vertigo, and a tingling heat in the limbs; and muscular tremors recur at moderate intervals. Barbiere mentions that he saw these tremors very strong, in a man, six hours after he had swallowed twenty-four grains of Camphor for one dose. When given in still larger doses, it determines powerfully to the head, causing congestion of the brain and other symptoms of excitement. From these observations, we may conclude that Camphor, whatever may be its primary influence, exerts a secondary stimulant power as soon as it is taken into the current of the blood. And it is in this point of view that I recommend it in your employment as a therapeutical agent. If we are desirous of obtaining its excitant effect, the dose should be large, namely, twelve or fifteen grains, and it should be combined with opium or aromatics; for in smaller doses its primary influence only is obtained. The diversity of

the action of Camphor depends on the dose in which it is administered. A modification of its action is produced by combining it with some other medicines; as, for example, with antimonials, nitre, and neutral purgative salts. In combination with opium and aromatics, its influence in *checking* the progress of gangrene, and in upholding the powers of the constitution in confluent small-pox, measles, and other eruptive fevers, when these take on the typhoid character, and the eruptions recede, has been well confirmed: and in these cases its effects can only be explained by admitting its excitant properties.

In that species of low fever in which the head is powerfully affected, and the pulse small, soft, and compressible, I have ordered it with much advantage in combination with T. Serpentariæ, whilst, at the same time, Calomel in gr. i doses, at intervals of three hours, was freely administered. It allays the irritability of the nervous system, and maintains the action of the surface. Heberden, nevertheless, states that he has seen Camphor given in ℈i doses, every six hours, in such cases, without abating the convulsions or inducing rest*.

Camphor has been, indeed, successfully employed in most fevers connected with a depressed condition of the vital energy. Etmuller thus expresses himself:—"Remedium in febribus malignis sine camphore est instar militis sine gladio;" and many others of equal note have borne their testimony in favour of Camphor in low fevers. As far as my own observations have extended, it is in *petechial fevers*, and in the *exanthemata*, or eruptive fevers, when these are attended with malignant symptoms, that it has displayed its powers in the most striking manner. This is what might be expected from the penetrating nature of Camphor. Its employment, however, is to be avoided when any tendency to cerebral or meningetic inflammation exists.

In an epidemic small-pox which raged at Berne, in 1735, accompanied with livid blotches, owing to subcutaneous hæmorrhages, the mortality was awful. It resisted every remedy employed by Haller, who treated it, until he discovered the means of cure;—"id vero," adds he, "fuit Camphora." He gave gr. xx for a dose, and continued its use until the desquamation of the pustules took place. The same advantages were obtained by Tissot, who combined the Camphor with mineral acids.

The influence of Camphor in nervous and spasmodic affections has been well ascertained. It derives its salutary power from the impression which it makes on the extremities of the gastric nerves, and the spino-cerebral organ. In mania, it was employed so early as the time of Paracelsus; and in one form of mania, in which the penis is contracted, the testicles drawn up

* Comment. p. 153.

towards the abdominal ring, and the scrotum empty and corrugated, Avenbrugger regards it as a specific*. But it has obtained a reputation which it is not entitled to; for although it appears to bring down the pulse in the most furious maniacs, yet it produces no abatement of their general sufferings: on the contrary, says Dr. Hallaran, "the countenance eventually assumes a livid aspect, the extremities become cold and insensible and equally livid with the face. The arterial blood seems as if concentrated in the vessels immediately issuing from the heart; the action of the lungs is impeded, and congestion, determining to the head, is often the inevitable consequence†." Many distinguished practitioners, however, have employed it successfully in mania: but they have administered it in large doses, and have persevered in its use. The effects detailed by Dr. Hallaran are, indeed, at variance with the opinion which places Camphor in this class of medicines: and would lead us to place it elsewhere, were the facts of its excitant power not otherwise determined. In intermittent fevers, Camphor has been employed as an antiperiodic: but it only operates as an excitant in aid of the salts of quina; and, in this respect, it is much inferior to opium, and many other substances of the same class. This opinion may, also, be given respecting its administration in rheumatism, gout, and cholera.

Camphor has been externally applied as an Excitant, with much advantage, in gangrenous sores, sprinkled upon the surface: and, dissolved in oil of chamomile, it has been used, in the form of fomentation in *meteorismus*, and in spasmodic colic. It has been employed by Dupasquier in the form of fumigation in chronic rheumatism. The quantity used at one time is half an ounce: it is placed on a hot metallic plate under a blanket, in which the patient is involved.

The volatility of Camphor aids the evaporation of watery and alcoholic fluids; and on this account it is advantageously employed as a component in evaporating lotions to the scalp, in fevers, and all affections in which the head is required to be kept cool. In such cases, its operation is that of a sedative; but when the quantity of Camphor added to the lotion is large, its stimulant influence overpowers its refrigerant property, and it proves hurtful instead of being salutary. In this case, its excitant operation becomes conspicuous. In solution in fixed oils, on the contrary, its volatility is greatly restrained; and consequently this is the best form of prescribing it, when we wish to obtain its influence as a rubefacient. This mode of topically employing Camphor as an excitant has been much resorted to in rheumatism affecting the joints: but nothing is more likely to cause

* Exper. de remed. spec. in Mania virorum. Vind. 1776.
† Practical Obs. on Insanity. Cork, 1818, p. 130.

metastasis, or a sudden transmission of the morbid action from the affected joints to some internal organ.

In summing up the properties of Camphor, it may be justly stated that it partakes of the properties of many of the other classes of medicines: that it proves *excitant*, or *sedative*, or *narcotic*, or *antispasmodic*, or *diuretic*, according to the combinations in which it is administered, and the condition of the patient at the moment of administration. In full doses, namely, from gr. x to gr. xx, given alone, in low and depressed states of the vital energy, its excitant power is displayed; in combination with antimonials and mercurials, it lowers action and operates as a sedative: with opium, its narcotic powers are developed and those of the opium augmented: with salts of quina, it is either excitant or antispasmodic; and with nitrate of potassa, the influence of that salt on the kidneys is both insured and increased. Its powers, in combination, of diminishing the drastic and griping powers of resinous cathartics, at the same time that it aids their purgative property, was formerly mentioned.

The next group of excitants, the fixed acrid oils, consists of plants containing acrid oil in a state of combination; and, except as local irritants, they have been little employed. All the *Peppers* owe their stimulant properties to these oils; and, although the antiperiodic power of Black Pepper has been attributed solely to the Piperina which it contains, I am greatly disposed to accord with Majendie in thinking that something is due to the excitant influence of the acrid oil with which it is combined, in its influence in the cure of intermittents. I am aware that this opinion is at variance with that theory which regards the paroxysm of ague as the sign of a local intermitting inflammation: but, assuredly, although inflammations may accompany ague, these cannot justly be regarded as the cause of its phenomena. It is not the object of this work to comment on the theories of disease: but, in throwing aside all theory, if we examine into the effect of some other antiperiodics, we shall find that their action, primary or secondary, on the capillary system is conspicuous; as, for example, arsenious acid, which is peculiarly useful in those intermittents in which the tendency to periodical recurrence is not only to be combated, but in which, at the same time, measures are requisite for subduing an inflammatory action, which, although slight in degree, yet is of a permanent kind. The arsenious acid, in such cases, seems, by its influence on the cutaneous capillaries, to operate principally by equalizing the circulation; and I am disposed to regard the influence of the fixed acrid oil of pepper as closely resembling that of arsenious acid: in its combination with Piperina, it forms that description of remedy which we look for in combining *Tonics* with *Excitants*.

The oil of Pepper has not been employed in its uncombined state, as far as I know; but, if my view of its mode of operating be correct, there is every reason for recommending it to be wholly removed in making Piperina, which, when perfectly pure, has frequently failed of displaying antiperiodic powers. It might be advantageously added to Extract of Chamomile flowers, which contains Piperina; but which does not exert much power as a remedy in ague, owing probably to the inferior excitant influence of the fixed oil with which the Piperina is combined in that extract: such a combination would form a cheap substitute for disulphate of quina, in the treatment of the intermittents of the poor.

Little requires to be said with respect to the other fixed oils in this group. That of Mustard is never employed uncombined; but the Mustard itself is an admirable local excitant in all cases of sudden transmission of diseased action to vital organs; as, for instance, in gout and rheumatism attacking the stomach or the heart. In such cases, the chief advantage of Mustard, as a cataplasm, is due to the promptness of its action, and to the facility of regulating it. Instead of diminishing the general energy of the habit, which is the case when ordinary blisters are employed, after their excitant influence has passed, the Mustard cataplasm rather tends to support the general energy; and, consequently, it is justly preferred in low and depressed states of the habit; such as occurs in typhoid fevers, when we wish to rouse the powers of the system, and at the same time to produce derivation. In such cases, the cataplasms are applied to the soles of the feet, or to the calves of the legs. My own experience has furnished me with sufficient proofs of the efficacy of the Mustard cataplasm in such cases. In epigastric tenderness, with irritation of the stomach, which occasionally appears in the early stage of fever, nothing so rapidly removes this condition of the digestive organ as the application of a mustard cataplasm to the epigastrium. Capsicum operates in every respect like the acrid oils, and has been employed in the same cases, and with similar advantages, as Mustard. Its topical influence, also, in malignant ulceration of the fauces is well established.

The next group of Excitants, the Alkaloids, is small, containing only Strychnia, Brucia, Delphia, Nux Vomica, and Arnica root: and some of the Resinoids, named *Aconitina* and *Veratria*.

We have already examined their *physical* and *medical* properties, and their *physiological* effects on the living system. Before mentioning their use and application as therapeutical agents, we should recall to recollection those facts which have been undeniably ascertained by experiments, respecting their influence specially on the spinal marrow, and the nerves emanating from it; as well as on the muscles which these supply.

Another fact is also important to be kept in view: namely, that, although these alkaloids and resinoids produce the powerful impressions and excite the tetanic convulsions which they always display when administered in large doses, yet, on examination of the bodies of animals destroyed by them, no traces of inflammatory action can be discovered, either in the mucous membrane or in the spino-cerebral apparatus, or its coverings. Now, from these facts, it is evident that their action is exerted on the nervous system.

Strychnia, in fact, is one of those excitants which causes no contractions of muscles, unless they operate through the influence of the central organs of the nervous system, when carried to them by the blood. This is rendered evident from the fact, that the division of the nerve supplying a part, suffering under tetanic convulsions, immediately causes them to cease. In poisoning, also, by Strychnia, the destruction of a portion of the spinal cord puts a stop to the convulsions in the parts, the nerves of which arise from that portion of the cord. Brucia, as well as Strychnia, and indeed all the active principles of the genus Strychnos, operate especially on the spinal cord; which is proved by the convulsions continuing after the brain is wholly removed. Reflecting on these effects of the influence of Strychnia and Brucia, and the vegetable bodies which yield them, we might venture to infer, independent of the results of experience, that they are admirably adapted to rouse the muscular energy of our frames, when it is depressed, or in a state of *torpor* or *atony*. It is, I presume, a logical conclusion, that agents which can augment the irritability so greatly as to produce convulsions and powerful action in muscles, in their customary state, are likely to rouse these to ordinary action when they are paralysed; at least, as far as this condition consists in defect of motion. But it must, also, be recollected that the phenomena following the administration of a poisonous dose of Strychnia are not confined to the motor nerves; the nerves of sensation, also, are so much excited that the surface becomes highly susceptible of touch, and even movements of the air are sufficient to awaken the convulsions which characterize the action of Strychnia.

Before these effects of Strychnia, and its influence on the nervous system, were demonstrated by the experiments of Desportes, Delile, Orfila, Majendie, and others, Nux Vomica was employed as a remedy in Pyrosis; a disease consisting of paroxysms of extreme pain and heat at the epigastrium, and a sensation of constriction, with the eructation of a clear fluid resembling water; depending in a great degree on atony of the stomach, and spasm. In this disease, Nux Vomica is administered in doses of ten grains three times a day. The disease is endemic in Lapland, and Nux Vomica is the remedy employed by the peasants for its relief: whether Linnæus received his information

respecting its powers from this source, I know not; but he strongly recommended it to the profession soon after his visit to that country. It was also employed in several other diseases, of which Geoffrey gives the following list: "exhibetur in affectibus comatosis, stupore, apoplexia, lethargo, paralysi, epilepsia asthmate et catarrho, fibre tertiana et quartana, ad urinas, menses et puerperia supressa provocanda, lumbricas expellanda; in dolere colico, cruditate ventricula et concoctione læsa, diarrhœa, tenesma et viscerum obstructionibus; nec non etiam adversus venena, venenatorum animalium morsus, et vulnera è tellis infectis*:" a long list, which rather displays the empirical character of the practice of that period, than throws any light on the nature of the medicine.

Since it has been ascertained that the active property of Nux Vomica is due to Strychnia, this alkaloid has been *successfully* employed in Paralysis. I put an emphasis upon the word *successfully*, because some physicians, whose opinions are very highly appreciated by the profession, have broadly asserted that it is of no value: but its power as a curative agent in Palsy has been too often demonstrated in the practice of Fouquier, Castaneo, Cramer, and Diffenbach, on the continent, and that of Dr. Bardsley of Manchester and others, as well as of myself, in this country, to admit of the smallest doubt.

I have already stated that Strychnia acts on the spinal cord. But it has been supposed that the idea of Strychnia operating especially on the lumbar portion of the spinal cord, may be objected to, from the circumstance of no pain or sensation being felt there. In traumatic tetanus, however, the same thing occurs; there is no neuralgic sensibility; yet, as in the action of Strychnia, a slight mental emotion, an attempt to swallow, even the friction of the bed clothes on the skin, will cause a paroxysm of convulsions, or tetanic twitchings. It is, also, a curious fact that inflammation of pharynx, œsophagus, and larynx, is often the result of an overdose of Strychnia; and it is a well-known fact that these are pathological phenomena of traumatic tetanus.

That the poison acts chiefly on the spinal cord, is rendered evident by an experiment of Dr. Stannius, who introduced nitrate of Strychnia under the skin of pigs, and divided the spinal cord: no tetanic convulsions followed†; but these follow the same dose applied when no division of the cord is made.

In prescribing Strychnia in palsy, two things require attention to insure success: 1, the nature of the attack, or condition of the patient; 2, the mode of prescribing the medicine.

1. It has been said that little is to be expected from Strychnia in that species of Palsy which is termed *anæsthesia*, the *paralysis of sensation*. This opinion is not correct. In a case which

* Geoff. Op. ii, 459.

† Muller's Archives, ii, 1837.

occurred in University College Hospital, in which the ganglionic portion of the fifth pair was paralysed, without any evident cause, the disease was rapidly cured by the topical application of Strychnia to a blistered surface on the temples. The sensibility of the integuments first returned in the vicinity of the blistered part, and extended gradually over the affected side of the face, terminating in that branch of the nerve which supplies the lower lip and chin, namely, the *ramus mentalis*. But it is in that form of Palsy which destroys the power of volition over one or more members of the body, *paralysis of motion*, that the powers of Strychnia are most displayed; more especially in that form of this species which is partial in its effects. Most palsies are coexistent with some change in the normal condition of the cerebro-spinal centres, or their ultimate ramification; and in many instances, the organic lesion is sufficiently obvious: for instance, *inflammation* of the medulla oblongata or spinal cord; *hardening* of the substance of those parts in which the membranes are implicated; *tumors* developed in the spinal marrow; *sanguineous* and *serous effusions;* and *fungoid thickening* of the dura mater; or *ossific growths*, either in that membrane, or from the parieties of the cranium or the vertebral canal. But there are forms of Palsy in which no appreciable alteration can be detected in any part of the nervous system: and it is in such that Strychnia proves most beneficial. The first object of the physician, therefore, in prescribing Strychnia, Brucia or Nux Vomica, or Arnica, is to enquire into these circumstances.

If the paralysis be nearly general, and, in spreading from limb to trunk, has been preceded by formication and numbness of the skin; by pains in the dorsal region, or a sense of fatigue and weakness of the spine; if the functions of the bladder and rectum are only slightly affected, and if the intellectual faculties are entire; some expectation may be raised of benefit from the use of Strychnia. We ought, however, to be aware that cases of this description sometimes depend on temporary venous congestion of the spinal vessels; and this may be spontaneously dissipated. In such cases, Strychnia may appear to prove useful, and yet deserve no credit. Before prescribing it, the utmost attention is required to ascertain that active vascular excitement does not exist in the membranes of the spinal cord.

Hemiplegia, or paralysis affecting one side of the body only, comprehending both the upper and lower extremities of that side, the most frequent form of the disease, may arise from effusion of blood within the cranium, the result of softening, or some other lesion of the brain; or from disease of the upper part of the spinal marrow. The side of the face is drawn, especially the angle of the mouth, to the sound side; the tongue is frequently half paralyzed; and the muscles of deglutition are more or less affected; the lower limb, in progressing, is propelled forward only by inclination of the trunk to the sound

side; and when the limb is raised, the foot falls again by its proper gravity; whilst the arm is pressed to the trunk, the fore arm, the wrist, and the fingers, being in a state of moderate flexion.

In this diseased condition of the habit, Strychnia cannot be employed when there is the smallest evidence of plethora, either inflammatory or apoplectic; but, when this has been subdued, either by the lancet, or by purgatives, or both, and mercurials carried to ptyalism, then it may be advantageously prescribed to restore the nervous power in the paralyzed limbs; and here it has one great advantage over most other stimulants—it does not excite the circulation when the dose is equivalent only to the effect which is required: that is, to the point of causing slight tetanic convulsions only on the paralyzed side. In general, the remedy has been administered too early, whilst the effusion still remains unabsorbed; whereas, it is only when the paralysis continues after the brain has been relieved, that it proves useful; or when the paralysis depends, not on such lesions as have been described either in the brain or the spinal cord, but on exposure to the poisonous preparations of lead, or of Mercury, or of Arsenic; or when it is co-existent with rheumatism, or some nervous affections, as, for instance, Hysteria, or Epilepsy, or Hypochondriasis. The danger of prescribing it whilst any excitement is present does not arise from its causing inflammatory action when the habit is still in a disordered state, as Andral asserts, but from its irritative influence operating on an already inflamed organ.

It is still more indicated in Paraplegia,—that is, when the lower half of the body is paralyzed on both sides, generally including the urinary bladder,—displaying its condition by incontinence, but more frequently by retention of urine, when these symptoms do not depend on diseased states of the brain, or its membrane,—a case, however, which is of rare occurence; for although the fact first pointed out by Dr. Baillie, that Paraplegia may occur from a diseased state of the brain, whilst the spinal marrow remains healthy, be undeniable, yet the usual symptoms of this form of Palsy denote a diseased condition of the *spinal cord:* namely, the tendency to spasm, the impairment of the sensibility of the skin, and the absence of the usual symptoms of cerebral disease. Paraplegia, also, is more frequently than hemiplegia the consequence of the poisonous influence of mercury, lead, or arsenical preparations.

Such are the modifications of Palsy in which Strychnia, Brucia, and Nux Vomica, prove useful; the conclusion we may draw from their consideration, is, that these alkaloids and the seeds containing them are chiefly indicated in cases which seem to depend on diminished nervous power; but that, even when cerebral disorganization exists, provided no inflammatory action be present, they may prove beneficial, if employed with caution.

We may also affirm that they are more likely to prove useful in *Paraplegia*, unconnected with disorganization, than in *Hemiplegia*; in *Hemiplegia* than in *general Paralysis*. In every instance, Strychnia promotes appetite and digestion, instead of impairing the powers of the stomach. Finally, we must recollect that it is necessary only to produce slight tetanic twitchings of the paralytic limbs; for when these are permitted to be too severe, debility follows, not only from the exhaustion of nervous energy, but from the deficient decarbonization of the blood which results from the spasm of the respiratory muscles arresting the mechanical movements of the chest. Whenever these occur, the use of the remedy should be suspended: and when it is again resumed, the dose should be smaller than when the twitchings occurred, and gradually augmented until they reappear.

2. With regard to the mode of prescribing the remedy, much difference in its activity depends on its insolubility, and on the greater or less acescency of the stomach of the patient by whom it is taken. The remark of Andral and some others, that it is a dangerous remedy, from the uncertainty of its action, some persons being so much more susceptible of its influence than others, must be referred to that fact, and to its administration in its simple form. It is seldom procured pure; and it is always more or less mixed with Brucia, which is six times less active. Now to secure the efficiency of the medicine, it is necessary, in the first place, to obtain it in as pure a form as possible; and, in the second, to prescribe it in such a combination as will render its action independent of the condition of the stomach. The latter can be readily affected by dissolving a grain of pure Strychnia in a fluid drachm of distilled vinegar, or of diluted sulphuric acid, or diluted Hydrochloric acid. Six minims of any of these solutions contain one tenth of a grain of acetate, or sulphate, or hydrochlorate of Strychnia, which is the proper dose to commence with. By gradually adding every day two minims to each dose, until the twitchings display themselves, we attain to the full dose; and when the Strychnia is good, the dose can seldom be extended beyond twenty minims. There are now Sulphates and Hydrochlorates of Strychnia; but they have not found their way into the British Pharmacopœias.

When Strychnia is administered in the cases and with the precautions just described, I have seldom found that it disappointed my expectations; and when it has failed, no injury has attended its administration. When there is much irritability of stomach, instead of being swallowed, it may be sprinkled on a blistered surface, in double the quantity requisite when it is internally administered: and this endermic method of using it is always to be preferred to its internal administration in local paralysis.

I have already stated the manner in which the local influence

of medicinal agents is produced, when endermically employed; and experience has fully demonstrated the truth of the explanation, by the influence which both narcotic poisons and Strychnia display when they are applied to isolated nerves.

Strychnia has been found useful in some other diseases besides paralysis. Dr. Bardsley has found it serviceable in amenorrhœa and in chronic diarrhœa; in both of which cases it seems, however, to operate rather as a Tonic than an Excitant; the dose is not required to be carried beyond a quarter of a grain, and no twitchings are experienced. On the same principles we must account for its success in the cure of ague, in the hands of M. Frisch, a German physician, who combines disulphate of Quina with four or five grains of Nux Vomica: and to its tonic influence we must also ascribe its efficacy in incontinence of urine.

If the precautions which I have mentioned respecting the condition of the brain be of much importance in the administration of Strychnia and of Brucia, they are still more important in prescribing Nux Vomica. Nux Vomica, besides operating on the nervous system, augments both the force and the frequency of the pulse; consequently, where there is any trace of inflammatory action, its employment is contraindicated. One of the most striking cases of its salutary influence is recorded by Dr. Trousseau. A man was paralysed in his lower limbs, with general tremors; the genital organs and the rectum shared the disease: but sensibility and the intellect were entire. Under the use of Nux Vomica, motion was completely re-established, the trembling ceased, the generative function returned, and the action of both the bladder and the rectum was restored The medicine was administered in the form of powder, in doses of gr. v, frequently repeated*.

Brucia has been employed on the continent instead of Strychnia; but it has not been generally prescribed by British practitioners.

It is necessary, whilst employing any Excitant in palsy, that the general system, during the use of Strychnia, Brucia, or Nux Vomica, should be kept in a very low state, by spare diet and frequent evacuations. The neglect of this precaution has given rise to much of the diversity of opinion which exists respecting the influence of these alkaloids.

The next group, the diffusible Excitants, comprehending alcohol in all its modifications, namely, wine, ardent spirits, cider, beer, and ethers, are now to be examined.

The physiological and dietetical influence of alcoholic fluids have been already described; as therapeutical agents, they are indicated in some fevers, and in those periods of fever which display a tendency to sinking of the vital powers; in cases

* Traité de Therapeutique, t. i. p. 520.

of great and increasing debility; in palpitation from causes operating solely through the nervous system, occurring when the patient is at rest, or even in bed when wakeful, in not being increased by exercise, and returning at intervals according as causes affecting the nervous system present themselves: and also in spasmodic affections proceeding from irritations of the plexuses of the sympathetic nerve, unaccompanied by any symptoms of lesion of the cerebro-spinal centres, pains of the back, the neck, or the head. It is, however, evident that wine and alcoholic fluids are seldom or never necessary in the early stages of fever; even in the latter stages, the propriety of their administration must altogether depend on circumstances, and the nature of the prevailing epidemic. The nearer that the symptoms approach those of typhus, the more they are likely to prove beneficial. It is in the stage of collapse, or failure of power, denoted by a rapid, soft, intermittent pulse, the tongue tremulous when protruded, low muttering delirium, tremors, subsultus tendinum, petechial eruptions, and the patient sliding to the foot of the bed, that they are especially required. Nor is the propriety of their administration lessened by the tongue being dry and streaked with brown or black, and the teeth incrusted with sordes, provided attention be, at the same time, paid to the local affections which these symptoms general indicate, and measures be taken for their relief. Even when the collapse is not clearly indicated; when, during the apparent favourable progress of the disease, the pulse suddenly becomes soft and compressible, the skin cool and clammy, with a feeling of exhaustion, especially if there be a desire for wine, the necessity of employing some of the articles of this group of Excitants is indicated. As far as regards quantity, from six to eight ounces of wine, or a pint of weak punch, may be allowed in twenty-four hours, at proper intervals.

These diffusible Excitants, under such circumstances, not only rouse the heart to more energetic action, but, not unfrequently supply to the organs that degree of support and tension which they require in this stage of fever. They abate delirium, ward off syncope, fill the pulse, and render it softer and less frequent. In many instances, when the supervention of local inflammation, in the latter stages of continued fever, demands blood-letting, either general or local, and the strength of the patient does not rally from the effects of this treatment, wine, brandy, ether, and many other excitants, are not only indicated, but absolutely required, to ward off what may be termed the *tendency to death*. Under such circumstances, I am in the habit of ordering white-wine whey, or Spiritus Vini Gallici, P. L., immediately after the bleeding, in small quantity, repeated at short intervals; and withholding it the moment the reaction is established.

With respect to the quantity of wine allowable in fever, no precise rules can be laid down; every thing depends on its effects. Sometimes the system is in that condition of insensibility to the

action of stimuli, that many bottles have been taken by persons unaccustomed to the use of wine, without any signs of intoxication, and without any very obvious increase of pulse, at the same time that it abates the delirium, subdues the *subsultus tendinum* and muscular tremors, and restores the natural temperature of the surface. In these cases, as when opium is administered in severe, painful, and spasmodic affections, the quantity of the wine is only to be limited by its effects. In general, however, too much wine is given in low states of fever: few cases of sudden exhaustion occur so urgent as to require a pint of wine in the twenty-four hours. It is always proper to give it in quantities not exceeding two table-spoonfuls, or a fluid ounce, and it is generally more relished by the patient when it is made into negus, with a little lemon-juice and sugar, than when it is simply diluted with water. It is also necessary, in the administration of wine and diffusible excitants, to bear in recollection, that the quantity and the strength of the stimulant should be apportioned to the age and the constitution, and to the previous habits, of the individual. Young persons are more readily affected in fever by wine than those advanced in years, who, also, more frequently display those symptoms which require it; and to one who has lived freely, wine is *more necessary* than to him whose previous habits in health have been abstemious.

With regard to the effects which are to regulate our continuance of the use of wine, or which demand that it should be withheld, if we find that the pulse rises, the heat of the skin is increased, the face flushes; and, instead of being tranquillized, the patient becomes uneasy and restless, or incoherent; we may then conclude that the use of wine should either be discontinued, or the quantity very greatly diminished. Again—if, instead of a gradual improvement of the symptoms, the patient gets weaker after each portion of wine, or lapses into his former state of exhaustion, any anticipations of benefit from its continuance will be disappointed. It should be slowly and gradually diminished in quantity as the train of symptoms for which it was administered abate: for although the system displays more susceptibility of its influence as these disappear, yet, when it is suddenly withdrawn, the morbid symptoms are very apt to reappear. The kind of wine should be chosen according to circumstances: in naturally delicate and irritable constitutions, and in the early stages of fever, *Claret* and *Rhenish* wines are preferable to *Sherry*, or *Madeira*, or *Port*. If brandy, or any other ardent spirit, be employed instead of wine, one half the quantity only should be prescribed.

In atonic dyspepsia, wine is not only to be allowed, but recommended, as the most grateful and useful means of rousing and invigorating the powers of the stomach; and even brandy is sometimes required; but both the wine and the brandy should be diluted:

and it is sometimes of advantage to administer these mixtures either *very cold* or *very hot*, but never merely tepid. In irritable states of the stomach, also, which are generally accompanied with pain, or much uneasiness soon after taking food; and in that condition of the digestive organ which causes pain, nausea, weight, or a sensation of gnawing when the stomach is empty, and which is attended with the vomiting of a viscid, semi-pellucid, glairy fluid in the morning, a moderate allowance of wine, or of brandy-and-water, is useful. But as dyspepsia often depends on a state of subacute inflammation, instead of debility of the stomach, wine and every diffusible stimulus is injurious; and such is, also, the case in rheumatic and neuralgic affections.

These remarks are applicable to Ether, which is more rapidly diffused over the system, but is more transitory in its effects, than wine or ardent spirits. In doses of twenty or thirty minims, in a glass of water, Sulphuric Ether stimulates the gastric nerves, and has a powerful influence in checking vomiting, and in allaying subsultus tendinum and hiccup in malignant or typhoid fevers. In doses of f℥i, taken just before the expected paroxysm of an intermittent, it very often succeeds in preventing its accession. With whatever view Ether may be prescribed, it should be borne in mind that, when continued for some time, the habit of taking it is apt to grow upon patients, and that dangerous consequences have followed from its abuse. Bucquet, a French chemist, was much tormented with colic, for which he took Ether, and found relief from it. He took a pint a day, which soon destroyed his life. The post-mortem examination of the body demonstrated the existence of some organic lesions in the stomach and colon, which must have been aggravated by the excitant influence of the Ether, and thence tended to hasten on the fatal termination of his disease. In noticing the physiological influence of Ether, I mentioned that it also hastened the death of the celebrated Dr. Graham, one of the most successful and most impudent of the Empirics which this country has produced.

The next group of Excitants comprehends Iodine, and its combination with Potassium.

We have described the physiological influence of Iodine on the skin, the mucous membrane, the glandular system, and the general habit; and, also, of its preparations: our remarks are, therefore, now confined to its therapeutical employment. It has been advantageously prescribed in almost every form of disease arising from or co-existent with diminished capillary action: *Chlorosis*, *Scrofula*, *Amenorrhœa*, *Dropsy*, *Bronchocele*, *Secondary Syphilis*, and all glandular affections.

In Chlorosis, the proportions of the constituents of the blood seem changed, the quantity of serum being proportionately great and that of the crassamentum small, which accounts both

for the pallor of the countenance, the languid and listless state of both body and mind, and the scanty and pale character of the catamenia. To relieve such a condition of the system, aperients and chalybeates are advantageously prescribed; but, in general, the progress towards a cure is slow. There can be no doubt that there is a deficient action of the capillaries; and, consequently, that the combination of an Excitant with the chalybeate is indicated: this is obtained in the Iodide of Iron, which is rapidly taken into the circulation, and whilst the Iodine it contains stimulates the capillaries, the Iron gives tone and support to the system. In this form, also, the irritative action of the Iodine is diminished, and the preparation does not cause the emaciation and wasting of glandular parts, which are almost always the result of the administration of Iodine in its uncombined state. In such cases, the Iodide is administered in doses of gr. iii to gr. viii, three times a day. The solution should be perfectly neutral, of a pale greenish-straw colour; and, to prevent it from being affected by exposure to the air, a coil of soft iron wire should be kept in it. But this is now rendered unnecessary by the preparation of the Syrup of the Iodide. I am bound in candour to mention that, although I introduced the use of the Syrup in this country, yet I have not the merit of suggesting it.

Scrofula is frequently engrafted on a feeble frame; but it appears sometimes in combination with a plethoric habit; although in this case the vigor of body is not greater than in the former; but, nevertheless, a line of distinction arises between the methods proper for treating these two forms of disease: the one requiring more especially Excitants, and less evacuation than the other; but both demanding those tonic and excitant means which communicate vigour to the constitution. The Iodide of Iron is admirably adapted to fulfil these intentions; but Iodine itself has been more generally employed; and its efficacy in removing scrofulous swellings of the lymphatic glands has been satisfactorily demonstrated. It is to M. Lugol that the profession is indebted for the advantages that have been derived from the use of Iodine in Scrofula. Experience has confirmed his representations: and he has shewn the greater advantage to be derived from the administration of small doses long continued, than from rapidly pushing the remedy to its utmost limit. When thus employed, there can be one opinion only of the power which Iodine possesses of controlling, if not always curing, scrofula; and this is greatly augmented by its combination with iron. Iodine, administered alone, has, also, been stated to be capable of inducing the absorption of tubercular deposites. It assuredly operates as a powerful excitant on the capillaries, and even on the absorbents. In whatever form it is administered in Scrofula, the dose should be small, and the use of the remedy persevered

in for a considerable time; for when given in large doses, long continued, it produces weakness and emaciation. Lugol, however, throws doubts on this observation, by asserting that, in his experience, thin females have not become emaciated, nor corpulent ones lost flesh. My own experience confirms this observation of M. Lugol: in two cases, in which the Biniodide of Mercury was administered in the solution of the Iodide of Potassium, the patients, ladies between thirty and forty years, improved embonpoint. In some habits, it operates like arsenic and the most acrid of the mercurial preparations; causing pain of the stomach, headache, and an inflammatory state of the mucous membrane of the alimentary canal, diarrhœa, and occasionally bloody stools. The tincture, or the wine of Cinchona, relieves the first of these symptoms: for removing the others, the remedy must be discontinued; and, if resumed, it should be administered in very reduced doses. In cases in which much debility has accompanied the use of Iodine, whilst at the same time it is reducing the scrofulous swellings, it has been customary to discontinue the remedy, and administer Disulphate of Quina, with the aromatic sulphuric acid; but, as the tonic and excitant powers exists in conjunction in the Iodide of Iron, I have been induced to employ it in the same manner as in Chlorosis; and experience has demonstrated the extent of its power to be considerable. Iodine may be also employed as a topical dressing to scrofulous sores, which it stimulates, and aids in promoting resolution, which is always desirable, and can only be effected in the early stages of the disease. If the moment to secure this be past, then Iodine aids in forwarding the suppurative process and the effort of nature to destroy the gland. I have had many opportunities of applying the tincture topically as a counter-irritant. It produces great heat of the part, which continues some hours and gradually subsides; leaving the cuticle to desquamate. By this means an immediate counter-irritation can be produced, in succession for many days, over any extent of surface. It is applied by a hair pencil.

If the Iodide of Iron be employed, the dose should not exceed gr. v or m. lxxx of a solution containing three grains in the fluid drachm. If the solution of the Iodide of Potassium be administered, containing Iodine in solution, the dose may be from half a grain to three grains of the Iodine, in a solution of three grains of the Iodide of Potassium in one fluid ounce of water. As in every other case in which Excitants are indicated, the diet should be nutritive, but as *little stimulant* as possible.

In Amenorrhœa, the preparations of Iodine operate as Emmenagogues: the remarks which I have offered respecting their value in this disease, will be found under that class of medicinal agents.

The propriety of administering Iodine in *dropsy* depends very much on the character and the period of the disease; or, in other words, whether the *sthenic* or the *asthenic* diathesis prevails. It is only in the latter case that it is proper; and here the most efficient preparation is the Iodide, or rather Biniodide of Mercury, the dose of which at first should not exceed one sixth of a grain, night and morning. Whatever may be the form which the dropsy assumes, the serous effusions are usually the consequence of local inflammation of cellular or serous parts; at least, such is the case in all those instances which may be called active; but the effused fluid may continue, although the circumstances producing the effusion have ceased; indeed the effusion is the means which Nature employs for relieving the inflammatory condition of the serous membrane. It is certainly not a case of diminished absorption: and it is problematical whether the Iodine does not operate rather by stimulating the capillaries than the absorbents. If the healthy action of the former be restored, the effused fluid will be gradually removed by the ordinary action of the latter.

I have had opportunities of observing the benefit derived from some of the preparations of Iodine in another disease, in which it has been seldom administered in this country by any other practitioner than myself. I refer to Cancer, in which I have prescribed Iodide of Arsenic as an auxiliary to Conium and mercurials, carrying the Conium to its utmost limit as to dose.

It is scarcely necessary to say that Cancer is a disease more common to women than to men, generally appearing either in the uterus or the mammæ, after the cessation of the menstrual discharge, that is, between forty-five and fifty years of age, chiefly in individuals of the lymphatic temperament, who have had no children. The causes of it are very obscure; but the disease appears to follow many exciting causes in individuals of a certain constitution or diathesis. Dr. Carswell supposes the matter of the disease to be deposited from the blood, in the same manner as nutritive particles, to enter into the molecular structure, and to assume the form and arrangement of the tissue into which it is thus introduced. The remedies which have been most successful in retarding and arresting its progress are those which exert a direct influence on the nutritive function of the affected organ, or act on the capillary circulation and the absorbents, and allay pain. Local bleeding, Iodine, Arsenic, and Conium, appeared well calculated to fulfil these indications, and they have not disappointed me.

It is in Bronchocele that the value of Iodine and its preparations have been most conspicuous. This swelling of the thyroid gland, so common in some parts of the continent, especially in Switzerland, is connected with that degraded condition

of our species, named *cretinism*; but by no means invariably co-existent with cretinism, as it is frequent enough in this country where no cretinism is found. In England, it is more common among women of a lax fibre than the opposite sex. The swelling embraces the whole gland, varying very greatly in point of magnitude. It is dangerous only by inducing disorder in the pulmonary circulation, sometimes causing palpitations, irregular and intermittent pulse, and occasionally a fatal disease of the lungs. It is unnecessary for our purpose to enquire into the causes of Bronchocele, on which subject medical writers differ most widely: in one respect they all accord; namely, as to the causes to which it has been attributed; that is, defective tone in the capillary system; but why this should be particularly displayed in the thyroid gland, is difficult to decide. It has disappeared suddenly, even after having resisted all remedies.

The beneficial influence of Iodine in Bronchocele has been confirmed by the most ample and extended experience. Not to mention the success of Coindet, Straub, Brera, and other continental physicians, that of Dr. Manson, in Nottingham, where the disease is endemic, is sufficient to stamp its value. Of one hundred and twenty cases, noticed by him in his work (*Medical Researches on the Effects of Iodine*), seventy-nine were cured, eleven greatly relieved, and two only derived no benefit. Much, however, depends on the character of the disease. In some cases, a change of structure takes place, and the gland becomes either cartilaginous or ossified; in which conditions nothing can be expected from Iodine. It is also essential before prescribing Iodine, to distinguish between the inflammatory and the scirrhous condition of the gland, which have been mistaken for goitre; as, in both states, Iodine is injurious. Iodine and the Iodide of Potassium are the forms of the medicine which have chiefly been used in Bronchocele, both externally applied and taken into the stomach. Of these two preparations, my own experience leads me to prefer the Iodine, which, although it occasionally produces mischievous effects, yet is, on this very account, the most efficient medicine. Dr. Manson's liniment, prepared with a fluid drachm of the Tincture of Iodine, containing three grains of Iodine and an ounce of compound soap liniment, is preferable, as an external application, to the ointment of either the Iodine or the Iodide of Potassium; but this remark does not apply to the ointment of the Iodide of Lead, which I consider the best external form of applying Iodine in this case.

When the skin is very irritable, the quantity of the Iodine should be diminished. For internal administration, the simple Tincture of Iodine, in the proportion of twenty-four grains of Iodine to one fluid ounce of alcohol; or a solution of the Iodide

to the extent of half a drachm to a fluid ounce of distilled water, or, what is preferable to either, a solution of Ioduretted Iodide of Potassium, composed of ten grains of Iodine and thirty of the Iodide in an ounce of distilled water, may be used. The dose of the last of these solutions should not exceed five minims at first: but it may be gradually increased to three times that quantity. In plethoric habits, it is necessary to preface the use of Iodine, in Bronchocele, by bleeding and the administration of a brisk purgative; and when the absorption is languid, this greatly accelerates it. Indeed, I have never seen these swellings disappear so rapidly as when leeches are occasionally applied during the course of Iodine, supporting the powers of the constitution at the same time. On this principle, I am disposed to think that the Iodide of Iron would operate most favourably in these cases. I have had several opportunities of trying its power, and witnessing its efficacy. When administered internally, the preparations of Iodine should be taken on an empty stomach, and their effects carefully watched, as they accumulate in the habit, and suddenly display their poisonous influence in symptoms closely resembling those of Asiatic cholera: and these sometimes occur even when the constitution is apparently improving under their use. It is of importance to know the conditions of the system in which Iodine is contraindicated. This is the case when there is any tendency to *congestion* either in the head or elsewhere; when *febrile* or *inflammatory symptoms* are present; or a predisposition to *hydrocephalus;* or any *gastric* or *hepatic* disorder; or a tendency to *tubercles* in the lungs. This last remark is at variance with those accounts which have been published respecting the advantages derived from the inhalation of Iodine in Phthisis; yet I have no hesitation in maintaining its accuracy. I must acknowledge that I have seen Iodine inhaled in one case only of this untractable disease; but the rapidity with which it hurried on the fatal termination was quite sufficient to convince me of the danger of its employment.

As I have already stated, the mischievous effects which sometimes follow the use of Iodine are suddenly displayed; but at other times they are insidious in their approach. The patient is affected with faintness, slight dimness of sight, palpitations, and other nervous symptoms; occasionally *tremors,* resembling *Chorea,* supervene on moving the limbs; and these are followed by choleric symptoms; namely, violent vomitings, spasms of the back and legs, a small, frequent, oppressed pulse, urgent thirst and excruciating pains of the stomach and the bowels. To prevent these effects, the suggestions of Dr. Barlow, of Bath, should always be kept in view:—1st, to improve the general health; 2nd, to increase the dose of the preparation gradually, and never to exceed the *minimum* quantity capable of acting on the local

disease. When the mischievous effects occur, the medicine must be left off, mild purgatives administered, gentle exercise in the open air recommended, with a mild, sparing, nutritious diet, and abstinence from wine and all stimulants. If the symptoms resembling Cholera supervene, they are best combated by opiates, hemlock, or hyoscyamus, warm bath, and demulcents. Sometimes the most alarming emaciation follows the use of Iodine; the mammæ and testicles are wasted; and these effects are accompanied by ptyalism. It is one important recommendation of the Iodide of Iron, that, whilst it affects the diminution of the enlarged gland in Bronchocele, it does not cause that wasting of healthy glands and that general emaciation which demands such close watchfulness in the administration of the other preparations. I have had ample opportunity of trying Iodide of Iron in Tabes mesenterica; and I am satisfied that it proves extremely useful, if cautiously administered, in conjunction with a course of mild mercurial alteratives.

As a remedy in secondary Syphilis, the combination of Iodine and Potassium—the Iodide of Potassium—is now well established. It sooner allays the pains in the limbs, and the other pains of that accompaniment of the disease which is termed Periostitis, than any other remedy with which I am acquainted; and, with the exception of Syphilitic Lepra, it is a powerful means of removing the usual forms of eruption attending this disease. In Syphilitic Lepra, however, the Biniodide of Mercury, in conjunction with Cinchona bark, is more powerful than any of the usual mercurial preparations. It sooner gets into the habit, and does not cause that depression of vital power which is too often the result of mercurials.

One of the most important of the inorganic groups of Excitants comprehends the preparations of MERCURY in all their varied forms,—*Sulphurets*, *Chlorides*, *Cyanides*, *Iodides*, and *Oxides*. In whatever manner they are introduced into the habit, they accumulate in it, and set up a febrile action, evidenced both by the state of the pulse and the nerves, and by an augmented energy in the whole secerning organs. This stimulant influence of Mercury, or rather the preparations of Mercury, is greatly modified by the manner of their administration and their doses; and, to a certain degree, by the nature of the preparation employed. In large doses, given at distant intervals, the mildest of them operate as local excitants; first, on the duodenum and the orifices of the excretory ducts of the liver and pancreas, through which the impression is conveyed to these glands; and secondly, on the exhalants of the alimentary canal, thereby unloading the vascular system and giving a fresh impulse to the capillaries.

In small doses, repeated at moderate intervals, all the mercurials are absorbed, and the whole glandular system is excited.

No accurate idea of the mode in which metallic salts are absorbed has been formed. I am of opinion that they are in many instances carried dissolved in the serum of the intestinal canal and of the skin. It is a well-known fact, that when a small quantity of a metallic salt is mixed with serum, and a larger proportion of Potassa is added than is requisite for the decomposition of the salt, the salt remains in solution combined with the albumen; and is thus easily absorbed. It has been suggested by Muller, that as the components of the metallic salts readily combine with albumen, and exist in the coagulum which they form, it might be an advantageous mode of prescribing them*. To return from this digression.

During the action of Mercury, the salivary glands being more susceptible of impressions than those of other parts of the body, their *normal* action is carried to its utmost, and ptyalism is the result. But in no circumstance requiring the therapeutical use of mercurials, not even when the habit is suffering from the poison of Spyhilis, does the introduction of mercurials into the habit require to be carried so far as to produce severe ptyalism. The affection of the salivary glands is necessary only as a *demonstration* that the system is under the mercurial influence; and to carry this to a higher degree, so as to induce either very profuse salivation, or the eruptive disease named *Eczema Mercuriale*, which high mercurial action produces occasionally in very irritable and hysterical habits, is not only unnecessary, but hurtful and dangerous. In these conditions of the body, the action of the Mercury is that of a poison, not a salutary or remedial agent. Wandering pains, muscular tremors, paralysis, epilepsy, apoplexy, or general emaciation and cachexia, are the results of the poisonous action of Mercury. The efficacy of Mercurials, when employed as excitants, depends on the excitant effect being moderate in degree; maintained for a sufficient length of time; and in not being disturbed by any other stimulus, dietetical or medicinal. The last of these rules, indeed, is applicable during the employment of every excitant intended to set up, and maintain for a given time, a new action in the habit. During a course of mercurials, therefore, if the use of wine and other stimulants be not prohibited, the specific action of the remedy is so much modified that when prescribed in Syphilis it fails to overcome that morbid action which is induced by the virus; and, consequently, the disease is not cured. It is necessary to remark here, that the influence of mercurials is greatly modified by many circumstances connected with the condition of the patient, as well as the nature of the preparation employed.

1. Those persons who are of a sanguine and choleric temperament, are more susceptible of mercurial action than other indi-

* Muller's Elements of Phys. Trans. by Baly, part i, p. 130.

viduals; and, consequently, it is necessary in them not to bring the habit suddenly under the full influence of the medicine.

2. Owing to idiosyncracy, some persons cannot bear certain mercurial preparations without danger; but, as they bear others with impunity, various preparations should be tried before such a person is pronounced to be incapable of bearing mercurials; and, if labouring under Syphilis, of being deprived of the only chance of cure.

3. Women are more easily brought under the influence of mercurials than men; and, as they operate specially on the uterine organs, it is generally considered proper that the use of this set of remedies should be suspended during the continuance of the catamenia; but it is doubtful whether the milder mercurial preparations, in moderate doses, can be productive of mischief. In pregnancy, their employment demands great caution. They do not, however, materially interfere with lactation; and, therefore, when infants are afflicted with congenital Syphilis, the mercurial influence can be communicated to the system of the child through the milk of the mother.

In a therapeutical point of view, there is scarcely a disease in which Mercurials may not be employed as useful aids to other plans of treatment: it would, therefore, be impossible, even when they are intended to operate as excitants, to attempt a catalogue only of the names of the diseases that may be benefited by them; I shall, consequently, confine my remarks to the general operation of Mercurials as alteratives, and to their value in those diseases for which they constitute the chief remedy.

As alteratives, Mercurials are more commonly employed than any other medicinal agents: their influence over the secretions and excretions, and even over the nervous system itself, when they are prudently administered, is of a most efficacious description. As they operate by changing certain morbid actions, chiefly of a chronic character, into healthy actions, in acting as alteratives, their efficacy, when given in small doses, in the form of blue-pill or of calomel, in chronic inflammation, must be regarded of this kind: few cases are more frequent than these; and, as the diseased action, although neither violent nor dangerous, is *silently* affecting structural changes and causing irreparable mischief, the influence of Mercury, which is generally relied upon, should be well understood. A new action is set up in the habit, and long continued; and it is from the result of this, on the secerning system, improving the general functions, that the diseased action, which has become fixed as it were by custom on the system, or parts of it, is gradually overcome. For example: irritable states of the bronchial and intestinal mucous membrane, of long continuance, have given way to an alterative course of Mercury; and no medicine is so commonly prescribed in disease of the mesenteric glands. In this disease, if we exa-

mine the practice of many distinguished men, we shall find that mercurials formed the active part of their prescriptions. Abernethy gave half a grain of Calomel with three grains of Ginger, every second night; Mr. Lloyd trusts chiefly to the blue-pill and laxatives, followed up by Plummer's pill and Sarsparilla; whilst Hydrargyrum cum Creta is the medicine of almost every one who ventures, or who is authorized, to prescribe. This, certainly, in combination with Rhubarb, improves the secretion of the liver and intestines; and, when succeeded by a course of Sulphate of Potassa, Calumba, and Rhubarb, with friction on the abdomen, I have seen it productive of the utmost benefit. But, in stating my opinion as favourable to the use of Mercury as an alterative in Tabes mesenterica, I must at the same time condemn the use of it when pushed so far as to affect the gums, or to salivate: than which nothing is more productive of injury in strumous habits. Even its long continuance as an alterative in irritable states of the mucous membrane, is of questionable propriety. Indeed, in such circumstances the use of Mercurials is by no means advantageous in any modification of Scrofula.

In almost every chronic disorder of the liver, and in other organs connected with the digestive function, Mercury is the remedy most frequently resorted to. In depositions, the result of acute inflammation; as, for instance, Iritis, inflammation of the Iris, nothing displays more strikingly the rapid influence of Mercurials, as excitants on the capillaries, than the disappearance of the pus deposited on the diseased organ, when the mercurial begins to display its effects on the habit. But, in this case, it is usually not regarded as operating as an alterative: in other cases, however, in which there is a disposition to new formations, the result apparently of simple irritation, mercurials produce the most beneficial effects; and these are strictly regarded as the consequences of the alterative influence of the Mercury.

When Mercurials are intended to act as alteratives, they should be given in very small doses, at bed-time, and repeated every night for some weeks. If Plummer's pill, for example, be prescribed, the dose should not exceed five grains, which contain one grain of Calomel: or, if the blue pill be used, from two to three grains are amply sufficient, if given night and morning, to produce an alterative effect. It must always be kept in recollection, that the employment of no mercurial can properly be continued for many weeks: if it produces no good effects in that time, a perseverance in the use of it will certainly not insure these effects; but, after suspending its use for eight or ten days, it may be advantageously resumed. If no benefit then results, it does not by any means follow that the other methods of treatment may succeed; and it has been well remarked, "that it is a delusion to suppose that no treatment, except the alterative, is really efficacious in chronic affections."

When Mercurials, thus used, have been judiciously prescribed, indications of their general effects may be clearly perceived. If the tongue, for instance, become clean; if the appetite improve; if the bowels act more regularly than before; if the skin take on a more healthy action, that is, becomes soft, smooth, and free from eruptions; if the mind acquire more buoyancy; the sleep prove tranquil and refreshing; and the countenance display that feeling of general comfort which is incompatible with chronic disease, then we may rest satisfied with the action of the alterative. It becomes, then, a matter of important enquiry, how long the alteratives should be continued; and, in replying to it, we must recollect that to persevere too long in the use of alteratives, is to apply to the body, in a state of health, an actual cause of disease: for the action upon which the benefit of alteratives evidently depends, is not that *natural* to the system, but one of *temporary* fever.

Among the diseases in which the alterative action of Mercurials admits of a diversity of opinion, undoubtedly Scrofula is one. Its influence in the form of Calomel and blue pill, aided by the use of saline purgatives, has been highly praised by Mr. Lloyd, in his Treatise on Scrofula. Other preparations, also, as Hydrargyrum cum Creta, and the Bichloride, have also undoubtedly been used with decided benefit: the *former*, when the secretion of bile is faulty or defective, combined with irregular action of the bowels: the *latter*, in minute doses of one-eighth of a grain three times a day, in scrofulous ulcerations and leucorrhœal discharge. The Bichloride, in such doses, operates as a healthful excitant to the mucous membrane of the alimentary canal and the cutaneous capillaries, inducing perspiration, and improving secretion. The mercurial ointment has been much used in Tabes by Mr. Brandish, who never, however, carried it to salivation; and, during its use, he supported the habit with mild, nutritious diet, and the internal administration of Liquor Potassæ.

In stating these effects of Mercurials in strumous affections, it is but candid to state that many practitioners of good reputation condemn altogether their employment.

In Dysentery, particularly that form of the disease which is common in tropical climates, Mercurials, if employed with prudence, are efficacious. From gr. i to gr. i ss of Calomel, combined with gr. v to gr. x of Dover's powder, or gr. ss of Opium; or gr. v. of Hydrargyrum cum Creta combined with the Opiate, may be given once in four or five hours, lengthening the intervals as the symptoms abate. In this case, the action of the Mercurial is truly alterative; it is quite unnecessary to make any impression on the gums. In warm climates, a grain of Calomel and of Ipecacuanha are given every hour or every two hours, till some effect is produced on the disease or on the system.

The employment of Bichloride of Mercury, in small doses, largely diluted, and administered in the form of enema, has

been found efficacious: but, as I have not seen it used in this form, I can only mention the fact.

Laryngitis, inflammation of the larynx, in its acute form, yields sooner to Mercurials than to any other remedy: and when the disease assumes a chronic form, in which the mucous membrane becomes thick and puckered, and throws out coagulable lymph of a striking character, which obliterates the cavity of the larynx, Mercurials prove highly serviceable.

In many obstinate skin diseases, Mercury has been administered; but in none more than in Lepra. It operates solely as an alterative, and as such is of unquestionable utility; but it is essential to keep it within the limit of salivation. The Bichloride in very small doses, namely, one eighth of a grain, or the Biniodide in doses of one fourth of a grain, are the best preparations in this case. In Rupia, an eruption of flattened bullæ, containing sero-purulent matter, and surrounded, each, with an inflamed base, the Bichloride is also useful. The matter in these bullæ concretes into a dry cellular scab, covering a deeper ulceration, which is continually secreting pus, and forming successive incrustations, until a conical scab, not unlike a limpet, rises, and extends at the base sometimes to an area of one inch and a half, or more. The Mercury should only be administered as an alterative, in very minute doses; maintaining at the same time the tone of the habit by nitric acid in any light bitter infusion.

The Bichloride has, also, been employed in the form of a bath, in chronic affections of the skin, accompanied with much itching, which rapidly disappears under its use. The strength of the bath may be from ʒii to ℥i of the Bichloride to twenty gallons of water. Beaumé was the first who prescribed these baths in extended affections of the skin; they fell into disuse; but their employment was revived by Wedekind, in 1829; and they have since that time been much used in the French hospitals. They have been rarely employed in this country. They generally, at first, cause headache, and a comatose tendency, with slight colic, and occasionally vomiting and diarrhœa. On continuing them, these symptoms disappear, and a papulous eruption succeeds; after seven or eight baths have been taken, the usual effects of mercurials on the habit begin to be felt, and salivation occasionally supervenes.

Such are some of the diseases in which Mercurials operate with advantage as alteratives. Those in which they are administered as *direct excitants*, and as the chief remedial agents, are Syphilis, general *Inflammation*, *Inflammation* of the liver, and Hydrocephalus.

In the treatment of Syphilis, notwithstanding the opinions of Mr. Rae, Dr. John Thomson, and others, that Mercury is not required, the prevailing opinion is in favour of mercurial management of that disease. Some advantages, however, have been

derived from the speculations of these practitioners; they have demonstrated that much less Mercury is requisite than has been prescribed; and that it is of advantage to bring the habit into a state of what may be denominated quiescence—one free from all febrile excitement—before administering Mercurials.

Soon after Syphilis appeared in Europe, and for a considerable number of years, practitioners were accustomed to administer mercurials in immoderate doses, repeated at short intervals, until profuse salivation occurred. This sometimes rose to such a height as to destroy the unfortunate patient; or, if he survived, he was left in a condition as deplorable as that caused by the disease which the mercury was intended to eradicate. The mistaken object of this plan was to bring the habit as rapidly as possible under the influence of the remedy, without any reference to the quantity necessary to effect a radical cure, or the length of time requisite for maintaining its influence on the system. The mischief thus produced by the abuse of mercury, lessened its reputation in the opinions of many; by others it was altogether inderdicted; and by a few only was it regarded as an antisyphilitic of decided efficacy. Notwithstanding these fluctuations of fortune, the preparations of Mercury still hold their ground as the best remedies in Lues Venerea that have yet been discovered: when administered with judgment, they are both efficacious and safe. When prescribed by the rash and the ignorant, they may fail of effecting a cure; and may exasperate and render the disease more intractable than if no mercury had been given. "My opportunities," says Mr. John Pearson, in his Treatise on the Effects of various Articles of the Materia Medica in the Cure of Lues Venerea, "have not extended to less than twenty thousand cases; and I feel myself fully authorized to assert, that it (Mercury) is a remedy always to be confided in, under every form of Lues Venerea; and, where we have only that one disease to contend with, that it is a certain antidote." I have thought proper to make these remarks before entering upon an examination of the value of mercury as a therapeutical Excitant in the management of Syphilis, because opinions are still current that mercury is not necessary in the treatment of any form of that disease.

Three points are requisite to be attended to in the treatment of syphilitic diseases by mercury.

1. The effects of the syphilitic virus, and the *state* of the disease produced by it, which *demands* the use of mercurials.

2. The intention with which mercurials are prescribed, and the rationale of their operation.

3. The selection of the preparation best adapted for each particular case.

4. The rationale of the operation of mercurials, and of some peculiar effects of Mercury in Syphilis.

1. Although Syphilis is a disease which is produced by *contagion*, the virus must come in contact with a recent or abraded surface, and enter the circulation, before the disease can be communicated. When the disease is propagated by sexual intercourse, the organs of generation are first affected; when it passes from an infant born with the disease to the nurse, the breast is first affected; when from a nurse to an infant, the lips and mouth of the child first suffer. When the virus is simply applied to a secreting surface, an erythematic or superficial inflammation supervenes, and the natural secretion of the part is augmented. When a true inoculation occurs, the first effect of the application of the syphilitic virus to the healthy body is local; but it is afterwards gradually conveyed into the system. It would be out of place here to trace the symptoms which follow from this introduction of the virus into the circulation: it is only when that occurs, that the administration of mercurials, so as to affect the whole system, is requisite; and it is, therefore, this state of the syphilitic disease that demands our attention.

2. Let us now inquire into the intentions which are to be answered in exhibiting Mercury in this disease. It is to raise a mercurial irritation in the system to such a degree as shall demonstrate that the body is charged with the remedy.

Salivation was long regarded as absolutely necessary for the cure of every case of Syphilis, on the supposition that the virus of the disease is evacuated by the salivary glands; and consequently that Syphilis can only be cured by the augmentation of the salivary excretion to a very considerable degree. This is, nevertheless, an error; and the objections to salivation being carried to any great extent are manifold. In the first place, the quantity of a mercurial necessary to cause a severe salivation excites a degree of fever quite unnecessary; and the irritability and debility which result from it cannot be borne with safety by many habits; as, for example, by the young below fifteen years of age, the old and naturally debilitated, and those prone to the formation of tubercles in the lungs. Salivation, also, in defiance of every means employed to check it, often advances so rapidly, that the face swells, the tongue enlarges, and the fauces are so much inflamed and swelled that there is danger of suffocation. Violent diarrhœas occur from the saliva being swallowed, or by the Mercury stimulating the pancreas. Besides these formidable objections to profuse salivation, epileptic fits have been, not unfrequently, occasioned by it: they have been supposed to depend on the Mercury overstimulating the brain, or on a portion of it being reduced and lodged in the cavities of the brain. I will not presume to decide upon these hypotheses: any cases resembling Epilepsy, which I have seen, arising from the stimulus of Mercury, have occurred in highly irritable habits; and I am disposed to think that it is the increase of susceptibility to im-

pressions, which would not otherwise affect the nervous system, that brings on those fits which have been called epileptic. The last objection which may be urged against salivation, is, that the ulcerations of the mouth, the caries and the loosening of the teeth, and the rheumatic affections excited by it, remain for a long time after it has ceased; and the whole constitution appears to have received a shock from which it scarcely ever completely recovers. On these accounts, *profuse* salivation is now seldom induced. When the disease has been of long standing and is very inveterate, salivation to a certain extent may be requisite, to ascertain the saturation of the habit with the mercurial: it is also sometimes advisable, in order to check greater evils and to remove obstacles which are almost too formidable to hold out any prospect of being removed by other means. Thus, persons addicted to intemperance and other depravities, and who have not sufficient control to alter their habits, are brought into a tractable state by being salivated; for then they can be restrained to a proper diet and withheld from their irregularities.

The quantity of any mercurial preparation necessary to be introduced into the habit to excite salivation, depends altogether on the condition of the patient and several adventitious circumstances, over which the physician can exercise no control. In some individuals, the susceptibility of the habit for receiving the mercurial impression is so great, that small doses of the mildest preparations will produce salivation. I have seen three grains of Calomel effect it; and Dr. Crampton has recorded a case in which two grains caused extensive ulceration of the throat and exfoliation of the lower jaw, which terminated in death; and a case of a similar kind is recorded of a lad of fourteen years of age, a native of Nepaul, who was destroyed by six grains*. In neither of these cases was there ptyalism. On the other hand, there are individuals of a state of habit so opposite to those just alluded to, that no quantity of any Mercurial, however introduced into the system, can excite salivation. A lady by mistake swallowed fourteen drachms of Calomel: she experienced acute pain at the epigastrium, vomiting, purging, followed by ulceration of the mouth, and salivation; but in three weeks she was recovered†. One ounce was also swallowed, and two hours elapsed before the mistake was discovered: no other effects than nausea and faintness followed. Emetics, lime-water, and purgatives, were administered; Calomel was vomited, and in two days the person was quite well‡. But these idiosyncracies are rare; yet they should be kept in remembrance during the administration of Mercurials.

Physicians had early remarked that the most urgent symptoms

* Lond. Med. Gaz. xviii. p. 484. † Pierer's Annalen for April 1827.
‡ Lond. Med. Gazette. vol. xxii. p. 600.

of Syphilis often disappeared before the salivation commenced; and that the disease was occasionally cured where little or no evacuation from the salivary glands had taken place. Owing to these and other circumstances, some practitioners rejected the plan of salivation. Almenar, a Spanish physician, who wrote in 1460, was the first who attempted to keep down and moderate salivation by the administration of purgatives. He was followed by very few for nearly half a century; but at length this became the general practice, and continued so until 1718, when the custom of exciting profuse salivation was revived, and followed for upwards of half a century. It is now generally agreed that much salivation should be avoided, and the mercurials pushed only as far as they can be without exciting it. The fœtor of the breath, the gums becoming sore and spongy, are sufficient indications that the habit is charged with the Mercury, and that the mercurial irritation necessary for the cure of the disease has been excited. The time which this method requires may be regarded as an objection; but this is a weak one. If, however, we consider that much time was formerly occupied in preparing the patient for salivation, and that the extension of the convalescence after its conclusion was great, both plans will be found to be nearly equal. The charge, that relapses are more frequent when salivation is not resorted to, is untenable, if due precaution be observed.

Upon the whole, it is obvious that practitioners formerly administered immoderate doses of Mercury, at too short intervals, and excited unnecessarily violent salivation. Neither were the practitioners of those times at all aware of the quantity of Mercury required to effect a radical cure of Syphilis; they were not aware of the period necessary for employing the remedy, "nor competent to distinguish," as Mr. Pearson remarks, "between the proper effects of the venereal poison and the pernicious consequences of an injudicious practice." Much evil attended the throwing in Mercury so as to induce salivation suddenly. The effects were often so severe that it was requisite to suspend the use of the remedy; and, when the evil was set aside, to recommence its use with caution. It may not be altogether out of place to mention here, that sometimes salivation does not occur during the period in which the use of the Mercury is continued, but after its administration has been abandoned. If we can trust the authority of Swediaur, several months have elapsed before the action on the salivary glands has been displayed. Salivation may also happen a second time, after a considerable interval, without the introduction of any more Mercury into the system. Mr. Bromfield, who had ample opportunity for observation in the Lock Hospital, has mentioned several instances of this kind; in one of which the interval was three months; in another, a periodical salivation occurred at intervals of six weeks for a whole

year after the use of the mercurials was abandoned. These, however, are uncommon cases. In fulfilling the second intention, that is, to excite a moderate mercurial irritation in the habit, it is necessary to keep in view the conclusions to which we have arrived regarding salivation. In the milder forms of the disease, a very moderate mercurial action only is requisite to overcome the morbid state which the introduction of the virus into the system has produced; and every step beyond this point to which Mercury is carried must be considered as injurious to general health. Mercurials acting upon a sound constitution must be regarded in the light of poisons: and there cannot be a stronger proof of this than the influence of a mercurial atmosphere on those workmen whose labours expose them to the operation of this poison; such, for instance, as miners in the quicksilver mines, gilders, barometer makers, and others. These workmen are frequently attacked with what is termed shaking palsy—a disease characterized by tremors of the arms, followed by convulsions of both upper and lower extremities, and which, when extended to the other parts of the body, render it impossible for the individuals affected either to walk or to raise food to their mouths, or even to speak or to chew; and which, if they be not removed from the atmosphere inducing the disease, terminates in stupor, delirium, and death. It is a curious fact, that those most liable to these tremors are not susceptible of salivation.

The difficulty of knowing how far salivation may be pushed is considerable. If the mercurial be applied through the medium of the surface, even where there is ulceration of the tonsils, in the form of what is termed the excavating ulcer—that is, a hollowed-out state of the tonsil, as if a portion had been scooped out; with ash-coloured sloughs, and a red, tumid margin—as soon as the gums are affected, the quantity of the ointment should be diminished one half; but it must be continued in sufficient quantity to keep up this degree of tenderness for a sufficient length of time, not only to overcome the diseased action, but also the habit superinduced by the syphilitic virus: and the best guide in this respect is the healing and cicatrization of the ulcers, and the complete desquamation of the diseased cuticle when blotches occur. Sometimes, after the conclusion of a mercurial course, a state of throat not very dissimilar from that which I have described, although less severe, may supervene some irregularity or imprudent exposure to weather. This is often mistaken for a return of the disease, whereas it is truly an effect of the remedy; and consequently, a return to the use of mercurials should not take place: but if a longer time has supervened between the leaving off the mercurials; and if this sore throat is accompanied with a papular, or scaly, copper-coloured eruption, we may then conclude that it is not the effect of the remedy, but of a renewal of the disease. This is not the place

for entering upon the consideration of the details necessary to be considered in the treatment of Syphilis: it is only with the remedy and its effects that we are occupied: and I may conclude this part of our inquiry by remarking that it is not the violence of the mercurial action induced, but the maintaining a moderate degree of it for a sufficient length of time, that is likely effectually to destroy the syphilitic action. With regard to the topical application of mercurial preparations, it must be remembered that corrosive sublimate, applied to a wound or ulcer, occasions dangerous symptoms: even where the skin is entire, it must be used with caution.

3. With regard to the preferable modes of exhibiting mercurials, little requires to be said.

The great advantage attending the use of the ointments is the facility which they afford of introducing a large quantity of the remedy into the habit before profuse salivation is likely to be produced: but their use is not unattended by some inconveniences. For instance, peculiar states of the constitution, or idiosyncracy, may produce so much torpor or want of action in the cuticular absorbents, that much time may be expended in the application, and little of the ointment be taken into the system. The mode in which the friction is employed is of importance: but as this must be left to the patient, we have little or no control over it; so that the quantity absorbed cannot be ascertained from the quantity employed. Besides, owing to the extreme irritability of some persons, the friction produces eruptions upon the skin, which interrupt the free and continued employment of the remedy. The two blue ointments, which differ only as to strength, are most commonly employed. Ointments also with the protochloride, or the white precipitate, or the grey oxide, are sometimes used in the same manner; but none of them remove either the local symptoms of the disease, nor affect the general system in so short a space of time as the strong mercurial ointment of the Pharmacopœias. The quantity of the ointments to be employed has been already mentioned. It is curious to look back into the practice of some of our best old authors, when they mention this remedy. Thus, Sydenham, and the practitioners of his time, used an ointment composed of one part of Mercury and two of Lard; and of this, one ounce was rubbed in for three successive nights. The consequence was severe salivation, which was kept up by the internal use of Turpeth-mineral, or by Calomel, exhibited whenever the flow of the saliva flagged. The patient was kept during the whole time in bed, and the most rigid abstinence observed.

With respect to the time for using the ointments, the evening is usually chosen; and certainly, as far as regards the convenience of the individual, that time is the best: but if we consider that, after repose, the skin is more elastic and soft, and that the vigour

of the absorbents must be in accordance with that of the general system, we should be disposed to prefer the morning for this operation. The friction must be assiduously continued until the whole of the ointment be absorbed; and the operation should be performed by the patient himself. It has been recommended, by some writers on Syphilis, that, when the patient is obliged to continue his occupations during a mercurial course, the ointment may be applied to the soles of the feet; so that the friction of exercise may cause its absorption. I have seen this practice followed; but the results were not such as authorize me to recommend it.

Another method of introducing mercurials into the system by friction, is that of rubbing Calomel on the internal surface of the cheeks and gums. It was suggested by Mr. Clare, and undoubtedly it has advantages. From three to four grains of Calomel, either in the form of powder, or combined with mucilage, is to be rubbed upon the gums. The saliva must not be swallowed during the operation, otherwise diarrhœa is apt to occur. It causes salivation; but not, as might, a priori, be supposed, from any topical stimulus communicated to the salivary glands and their excretories, but from being absorbed into the circulation and influencing the system. We have also sufficient evidence that the Calomel is decomposed in this case; as gold worn in the pocket is whitened in the same manner as when the blue ointment is employed. It is certainly a clean mode of affecting the system. It cures the disease, and even in a shorter time than the blue ointment; but it is apt to excite salivation too soon, and to carry it too far. In using mercurial frictions, it is better that the effect should not be sudden; as, in that case, the continuance of its influence on the habit is too evanescent, and a full charge of the remedy is not accumulated in the body.

The form of introducing Mercurials into the system by fumigation was suggested soon after the discovery of the remedial powers of mercurials in syphilis. Cinnabar was the preparation employed; and, as a relic of a prior practice, gums and aromatics were added, and occasionally sulphur and arsenic. The fumigations were applied to the whole body; but, owing to the dangerous results that occasionally followed this mode of practice, it soon fell into disuse. In 1736, a person of the name of Charbonnier, whose operations were superintended by the faculty in Paris, revived the use of fumigations on a new plan: but many having fallen victims to his treatment, fumigations again fell into disuse, and were neglected until 1776, when they were revived by M. Lalonette. He discarded the sulphurets and employed Calomel and the oxides, using a fumigating machine invented by Nicolas de Blengy in 1683, a little modified. The plan of this individual was fairly put to the test of experiment by the late Mr. John Pearson, in the Lock Hospital; and the

conclusions he deduced from his trials were—"that where checking the disease suddenly is an object of great moment, where the body is covered with venereal ulcers, or where the eruptions are large and numerous, so that there scarcely remains a free surface large enough to absorb the ointment, the application of the vapour of Mercury will always be attended with evident advantage." But he found it difficult to introduce a sufficient quantity of Mercury, by this means, into the animal system to prevent a relapse; and he therefore concludes his account of his experiments in these words:—"I consider it (fumigation) as a mode of treatment by no means eligible in general practice." Mr. Bacot, in his excellent and highly instructive Essay on the Nature and Treatment of Syphilis*, mentions the work of Dr. Rapou at Paris, in which the advantages to be derived from fumigation are minutely and fairly stated. Mr. Abernethy, in my opinion, proposed the simplest and best mode of fumigation. He placed his patient in a vapour bath, in a complete suit of flannel under garments, with a cloth covering the bath. Two drachms of the grey-oxide of Mercury were then put upon a hot iron placed within the bath: and in fifteen or twenty minutes, the whole body became covered with a white powder. The patient was then put to bed, in the same clothes, and lay in them until the next morning, when he was placed in the tepid bath. Mr. Abernethy regarded this as the most gentlemanly way of curing Syphilis; and says that he has seen it produce salivation in forty-eight hours. In the few instances in which I have witnessed its employment, it has not acted so quickly as Mr. Abernethy mentions, and the effects have not been permanent.

The last method of topically introducing mercurials into the body is by means of lotions or baths. The Bichloride or any of the preparations soluble in water are used for this purpose; and the body, or a portion of it, is immersed in the solution. Syphilis has been thus cured; but, owing to the dangerous excitement caused by these baths, when any portion of the surface is abraded, the practice is not to be recommended.

4. In treating of the comparative merits of those preparations of Mercury which may be taken into the stomach, the protoxide, as contained in the common blue pill, may be first; and, when properly prepared, it is the best of this set of remedies, because it is the mildest of those which certainly mercurialize the habit. It seldom, unless improperly prepared, incommodes either the stomach or the intestines. But, when turpentine has been used to assist the oxidizement of the Mercury, or when the conserve of roses with which it is made contains sulphuric acid, the blue pill is apt to gripe and run off by the bowels. From the mildness of its operation, the blue pill is peculiarly

* Medical Gazette, vol. ii, iii.

well adapted for those whose habits have been previously debilitated, or who are naturally delicate. In some persons, however, owing to idiosyncracy, it proves too active, unless it is corrected either by opium or by the addition of a few grains of rhubarb, given in the morning, which, by supplying a little tone, renders the intestines less irritable, and consequently less susceptible of those irregular contractions which cause griping. During the administration of the blue pill, the use of acids should be avoided; and, if the stomach be in an acescent state, the superabundant acid should be neutralized and carried through the bowels, or the stomach should be emptied by means of an emetic, and alkalies afterwards exhibited to allay the irritability of the organ. In doses of from five to twelve grains, given every morning and evening, this pill soon displays its influence upon the habit: salivation can be as certainly produced by it as by any of the more acrid preparations; and, at the same time, its activity is completely under control. When a dyspeptic state of the stomach accompanies Syphilis, Hydrargyrum cum Creta is sometimes preferred to the blue pill: it may be given in doses of a scruple or half a drachm for an adult, every morning and evening. But the effect from this preparation is slow and uncertain. In cases of congenital Syphilis, however, it is the only preparation which can be used, as it may be given to young infants.

The grey oxide, although precipitated from active salts, yet is a mild preparation of the metal in the first state of oxidizement; and that form of it prepared by precipitation from Calomel has been regarded by several distinguished practitioners as more certain, and yet milder, in its effects than the blue pill. They affirm, with truth, that it incommodes the stomach and bowels less than the blue pill; that, from its more minute mechanical division, and consequently being more perfectly combined with oxygen, it acts with greater certainty than that preparation; and that it is more easily prepared, and less likely to be adulterated.

The peroxides, particularly the Binoxide, per se, were formerly much employed as internal remedies in the cure of syphilis. From the difficulty, however, of preparing this Binoxide, it fell into disuse, until the time of John Hunter, who considered it one of the best of the mercurial preparations. It is, however, very apt to induce griping, diarrhœa, and tenesmus; and, therefore, Mr. Hunter always combined it with opium and oil of cloves; but, in spite of these combinations, it cannot be given in doses exceeding half a grain, without greatly incommoding the bowels; and, therefore, it is now seldom employed: nor is this neglect undeserved, since it possesses no advantages over other preparations, which are less acrid and virulent in their operation. The Binoxide, prepared by the decomposition

of the Nitrate and the Hydrate of the Binoxide, prepared by the precipitation of the Bichloride by a pure alkali, are even more objectionable than the Binoxide per se; consequently, the preparations are now entirely confined to external use, as topical Excitants.

The *Chlorides* are very active preparations. The Chloride, or Calomel, is not a more efficient preparation than any of those preparations in which the Protoxide is supposed to exist. In small doses, although it is insoluble in water, yet it is soluble in the gastric juice. This is more easily explained, since the experiments of Dr. Prout have demonstrated the presence of hydrochloric acid in that secretion; and, consequently, it is partially converted into the bichloride, or a state approaching to it, in the stomach. In doses smaller than those which excite purging, it is a preparation well adapted for the cure of Syphilis, and is less apt to induce sudden salivation than any other; it is, therefore, preferred for those who are readily salivated, and where the bowels are not very irritable; and, even in those with irritable intestines, it is more gentle in its operation than the Binoxide. It should be given, at first, in doses not exceeding half a grain; and, if this run off by the bowels, or gripe, opium may be added to it. Combined with antimonials, it is a diaphoretic; with squill and foxglove, a diuretic; and it aids the force of the milder purgatives, whilst it moderates the acrimony of the more drastic. It is, therefore, peculiarly well adapted for those secondary cases of Syphilis characterized by cutaneous eruptions; and when exhibited to infants in these cases, it produces much less disturbance of the abdominal viscera than would, a priori, be expected. The best form of administering Calomel is that of pill: or, when pills cannot be swallowed, and the form of powder is objected to, it may be mixed with water, by means of mucilage of gum tragacanth, which, owing to its viscid, mucilaginous nature, is well adapted to suspend a heavy, insoluble powder in a moderate quantity of fluid. Whatever may be the chemical distinction between the sublimed and the precipitated Calomel, they exhibit, undoubtedly, a considerable diversity of action. The precipitated Calomel irritates the stomach and bowels more than the sublimed; nor can it be used for so long a time, nor in such quantities.

The Bichloride is the most active of all the Mercurial salts. It has been supposed that it was first used as a remedy by Basil Valentine. Be this as it may, it was introduced into England for the cure of Syphilis by Richard Wiseman, early in the 17th century: but its employment was violently opposed at this period; and it was consequently neglected until Van Swieten recommended it as a preparation of singular efficacy against every form of Syphilis*. Mr. Pearson† supposes that Swieten

* Commentaries xviii, 294. † Observ. on various Art. of the Mat. Med. p. 99.

derived his knowledge of the efficacy and safety of this remedy from Dr. Sanchez, who resided many years at Petersburgh, where the remedy was used long before its introduction into Great Britain. Of three hundred persons cured by the Bichloride, in 1754, all remained well in 1755, and two hundred more were added to the list: but the most striking results of its success are recorded by Dr. Locher, physician to the Venereal Hospital in Vienna, in which the bichloride had been able to effect a complete cure in 5000 cases. Many respectable authorities in this country might be brought forward in its favour. In France, M. De Horne, who made experiments to ascertain its efficacy, by order of the government, expressed himself satisfied that the cures performed by it were real and permanent: and Dr. Cirillo, a Neapolitan physician, who used it externally as an ointment, affirmed that it is milder and less uncertain than any other Mercurial in general use. Besides rubbing in this ointment, Dr. Cirillo employed warm baths, once in three or four days; and he assures us that the mouth is seldom made sore, and that the medicine operates principally on the skin and kidneys. In opposition to these statements in favour of the Bichloride, we find that Mr. Bromfield, after employing it in the early part of his practice, asserts that it cannot be depended upon: an opinion which was supported by Mr. Gataker, and also by M. Louis, men of high authority upon this subject; Mr. John Pearson has also decided against it. Mr. Pearson admits that it will sometimes succeed in curing the primary symptoms of Syphilis, yet contends that it is a medicine which cannot be confided in where secondary symptoms have appeared. From its acrimony, it frequently gripes, causing spasmodic contractions when taken even in small doses; and occasionally has the power of producing cough, hæmoptœ, consumption, and similar diseases; and when it has apparently cured Syphilis, the symptoms have frequently returned.

My experience has taught me to rely on it in cases of syphilitic eruptions; particularly those which assume the characters of lepra. In these cases, I generally order it in solution in nitric acid, in the proportion of one grain to f℥i of the diluted acid, so that six minims contain the sixth part of a grain of the Bichloride. I have generally given, at the same time, either the decoction of Sarsaparilla or that of Elm bark; and, by gradually increasing the dose to ten minims, or one sixth of a grain of the salt, I have seldom failed in curing these eruptions. I have never seen it produce salivation when thus administered. Mr. Pearson admits that the Bichloride may prove beneficial at the commencement of a Mercurial course, "to bring the constitution under the influence of Mercury at an earlier period, or during the course of inunction, with the intention of increasing the action of simple Mercury. He also admits its efficacy, after a course of friction, to prevent a relapse."

The Bichloride may be also used in the form of pills, in doses of from one sixth to one eighth of a grain, combined with opium. Dr. Dzondi, of Hallé*, affirms that he cures syphilis radically by giving it in pills containing one twentieth only of a grain, beginning with four a day, and gradually augmenting the dose, until thirty are taken in the same period of time. If they purge, he adds a few drops of tincture of opium to each dose; if the gums become spongy, he washes them with an astringent lotion; and during the whole course, the food is reduced to one fourth. Dr. Dzondi, however, does not solely confide in these pills, but administers the decoction of Sarsaparilla after they have been continued for some time. The Bichloride has been given more frequently in solution in alcohol—a form of administering it which was first suggested by Van Swieten. His solution contained half a grain in a fluid-ounce of alcohol; and of this solution a tablespoonful was given for a dose. It was generally conjoined with opium, or some mucilaginous liquid, to prevent gripings. The Bichloride has also been occasionally exhibited in distilled water, with a portion of Hydrochlorate of Ammonia to facilitate its solution, and to increase its tendency to pass off by the kidneys and the skin. The proportion of the Hydrochlorate is double that of the Bichloride, and each fluid ounce of the solution contains half a grain of the Bichloride. As far as Syphilis is concerned, the chief use of the Bichloride is to make a sudden impression when any particular symptom is gaining ground rapidly: in these cases, if it produce griping and purging, it should not be persisted in. As an alterative, in affections of the throat in which there is some reason for thinking that the remains of a syphilitic taint are lurking in the habit, the Bichloride, dissolved in nitric acid and given in doses of one tenth of a grain, with Sarsaparilla or the decoction of Elm bark, has proved successful in my practice. I may mention that, in such cases, I have seen no benefit derived from the use of the remedy, if the patient be permitted to take his usual diet, and to use, even moderately, either wine, spirits, or porter. It seems essential for securing the efficacy of the medicine, that no other stimulant should interfere with its action on the habit; and if we admit the theory that the fever of Syphilis is to be knocked down by setting up another in the habit, we can easily understand how its influence may be interrupted by the use of other stimulants, whether dietetical or remedial.

The Iodides of Mercury have only lately been introduced into practice. They possess one advantage over the other preparations,—namely, they are more rapidly carried into the

* Richter's Ausf. Arzn. v. p. 596.

system, and operate more decidedly upon the capillaries than either the Oxides or the Chlorides. They are most obviously useful in affections of the skin, especially those of a syphilitic character. In cases of congenital Syphilis, as they pass more readily through the mammæ, and can be detected in the milk, they are the most useful of all the Mercurials when we wish to influence the infant through the system of the mother. In the external application of the Iodides in ointment to an ulcerated or a denuded surface, much caution must be taken not to make the ointment too strong, as its irritant property is likely to be productive of harm.

All the preparations of Mercury, when properly used, will cure Syphilis; and therefore a practitioner may, to a certain degree, please his fancy in the selection; but still, where a guide is desired, the few that are requisite should be pointed out. Those for topical application may be reduced to the common Ointment; the solution of the Bichloride; the Black wash; and the Binoxide or its Hydrate. As an external means of introducing Mercury into the habit, the blue Ointment and Calomel may supersede all other preparations; and for internal exhibition, the Blue pill, Calomel, and the Iodides, are adequate for every purpose.

5. In curing Syphilis by Mercury, it is necessary to recollect that many circumstances may interfere with the regular operation of the remedy. Thus, with respect to climate, the human system is in general more susceptible of the impression of medicinal agents in warm climates than in cold; a smaller quantity of Mercury, therefore, and a shorter period for its application, will suffice to cure the disease in a warm climate than in a cold. It was the custom in the time of Sydenham to send syphilitic patients to the south of France, as experience has demonstrated that a much larger quantity of any mercurial preparation can be thrown into the system without producing salivation in that climate. For the same reason, Mercury is more advantageously used in summer than in winter.

Women are more quickly brought under the Mercurial action than men; and, as it augments the discharge of the catamenia, the use of Mercurials should be suspended for some days previous to, and during, the continuance of this periodical evacuation. In pregnancy, also, Mercurials should be used with great caution. It is not so injurious during nursing. When infants are affected with congenital syphilis, whether the exhalation from the body of the mother, or the milk, being impregnated with the remedy, communicate the Mercurial influence to the system of the child, I will not venture to determine; but it is certain that the disease in the child has frequently been cured through the system of the nurse.

The sanguine and the choleric are more susceptible of the

mercurial impression than other individuals; and, therefore, in syphilitic affections which require, or seem likely to require, a protracted course of Mercurials, great caution is necessary not to bring the habit suddenly under the full influence of the remedy. Some idiosyncracies are ocsasionally met with which prevent the free use of Mercury in certain individuals; and as this sometimes occurs in reference to peculiar preparations and not to others, it is proper, when a person seems to suffer from the preparation in use, to try others before pronouncing that his system will not bear Mercury. When symptoms of either Erythema or Erithismus display themselves, the use of the remedy must be instantly suspended, and the irritability of the habit subdued by a free exposure to cool dry air and by a removal into the country.

Besides Syphilis, *Inflammation* is controlled by Mercurials; and its progress often arrested, when they are administered either in conjunction with blood-letting, or in cases in which the loss of blood is deemed inexpedient. This is well illustrated in Laryngitis, which is characterized by redness of the whole laryngeal membrane; but the symptoms arise from inflammation circumscribed to a definite region of the larynx, that portion of mucous membrane which covers the arytenoid cartilages and forms the glottis, diminishing this aperture so much that inspiration is impeded and the danger of suffocation becomes urgent. In this case, if resolution do not take place between the thirtieth and sixtieth hour, fatal suffocation is the result; or, if this be delayed beyond four days, a chronic form of the disease, with ulceration of some part of the organ, ensues. Under these circumstances, it is important to obtain the first result—namely, resolution, as quickly as possible; and, for this purpose, after general or local bleeding, two grains of Calomel or five of Hydrargyrum cum Creta are given every alternate hour, until the object be attained, and some decided amendment in the symptoms become evident. There can be little doubt, indeed, that it exerts a peculiar power in controlling the action of the capillaries, and of preventing those changes so destructive to the organization of inflamed tissues from taking place. If the inflammation have assumed a chronic form, and consequently is less likely to be beneficially influenced by blood-letting, Mercury may be administered with the most decided advantage: and the quantity must depend on the violence of the inflammation and the organ which is affected: but, unless the inflammation be of the urgent kind which I have described, the mercurial may be given at longer intervals, in four, six, or eight hours, according to circumstances. If it should purge, as opium is sometimes improper, it may be combined with an astringent, such as Catechu or Kino: or, if there be much acid in the bowels, with chalk. I am in the habit of ordering much larger doses of Calomel, from

six to ten grains, and repeating them at moderate intervals. I am not prepared to defend the superiority of this practice over that in which small doses are administered: both cure the disease, when it is curable. In the inflammatory diseases of tropical climates, which run their course with frightful rapidity, the introduction of Mercurials as quickly as possible after venæsection affords the only chance of saving life.

Although Mercury produces its salutary effects in these cases by its excitant action on the capillaries, yet, when pain is present, no disadvantage arises from combining it with opium. But, as a general rule, this combination is inadmissible until the excitement be reduced, or at least much subdued. This method of administering Calomel in inflammation was introduced by Dr. Hamilton of Lynn Regis, in 1783. He employed it first in Hepatitis, and, finding it successful, he extended the practice to peripneumony, pleuritis, interitis, puerperal fever, and, indeed, almost every modification of internal inflammation, as well as to acute rheumatism and gout. After bleeding, and evacuating the intestinal canal, he administered a pill containing from one to five grains of Calomel, and from a quarter of a grain to one grain of opium, according to the age and constitution of the patient, and repeated it every six, eight, or ten hours, as the intensity of the inflammation and the necessity of the case required. When the fever ran high, with a dry parched skin, tartar emetic, and sometimes camphor, were added, to determine to the skin, or to promote the action of the kidneys. If the disease did not yield in twenty-four hours, more blood was abstracted, and the calomel and opium were administered at shorter intervals. The relief was obtained without ptyalism, and indeed often without any visible evacuation, except a slight augmented flow of urine, or insensible perspiration. It was most striking when the Mercurial was early resorted to. Many have ascribed the benefit to the other medicinal agents with which the Calomel is combined: my own observations and experience are decidedly in favour of the mercurial influence in these cases. I have frequently witnessed the most striking benefit obtained by Calomel and Tartar emetic after venæsection, when no opium was prescribed: but, in irritable habits, the opium is essential; and probably, in every case, the advantage of giving opium with at least the first dose of Calomel after venæsection, has been so well confirmed by experience, that it should never be neglected. The action of the heart is controlled, while the nervous system is tranquillized: the patient generally enjoys an interval of refreshing sleep, and awakens with a soft pulse, open skin, and freedom from pain.

In chronic inflammation of the liver, the indication is to remove all unnecessary excitement from the liver; but, at the same time, to stimulate to a certain extent the capillary system.

With this view, small doses of Calomel, or of Blue pill, in combination with a few grains of Dover's powder, at bed time, or mercurial inunctions over the whole region of the liver, are serviceable. In the acute form of the disease, after general and local blood-letting, the mercury is generally pushed to ptyalism: but this treatment, if followed at all, should be delayed until the local depletions have diminished the sensation of heat and oppression in the hepatic region; till the pain and tenderness have subsided; and also the tumefaction, which is to be carefully ascertained. At this time the establishment of the mercurial action in the habit is commonly followed by a diminution of the local disease. I should say there is no necessity to excite salivation: but this caution is scarcely necessary, as it is extremely difficult to do so in this condition of the habit. The greater the disease, the greater the difficulty of inducing ptyalism; consequently, the most certain mode of bringing the habit under the mercurial action is to reduce the inflammation of the organ as far as possible previous to its administration. If suppuration has taken place, it is scarcely possible to cause salivation. The best mode of administering the Mercury in acute hepatic inflammation, is to give doses of eight and ten grains at long intervals: the irritability of the stomach is thus greatly allayed; and the system becomes sooner affected than with double the quantity of the Mercurial, given in small doses at short intervals. Ten grains of Calomel and one of Opium may be given twice a day: In India, the custom is to give scruple doses at bed time; but the influence of climate must not be overlooked in this case. If ptyalism be essential, this is always advanced by conjoining the Calomel with antimonials; an effect which can be readily explained by the influence which these exert in reducing excitement, and the effect of this in promoting absorption. It is the high degree of excitement which renders it so difficult to mercurialize the habit in hepatic inflammation; consequently, bleeding, and whatever tends to reduce tension, afford the best means of facilitating the introduction of mercurials into the system.

In no inflammatory disease has Mercury been so long, and, I may add, so unprofitably employed as in Hydrocephalus. In this disease the pia mater and arachnoid membranes are in a state of acute inflammation. There are many precursory symptoms which should not be overlooked: when the attack really commences, it is characterized by pains of the head, aggravated by motion, and sometimes attended with vomiting. These, at first, abate and recur at short intervals: the child looks uneasy, sighs, lays down the head, which seems too heavy to be supported; contracts the eyebrows, and complains of the influence of light on the eyes. The abdominal viscera now become deranged, and the stools, which are, at first, clayey, acquire a green, glazed appearance, and a peculiar heavy odour. By

degrees the pulse becomes rapid, the fever rises in violence, the headache increases, and an augmented sensibility to every external impression is evident. In this, the second stage of the disease, the abdomen is tender on pressure; the pulse increases in frequency, but becomes small and feeble; the cheeks are flushed; and the most piercing screams are often uttered, when the little patient is dropping off to sleep. In the last stage of the disease, the pulse cannot be counted, for I conceive that it is impossible to ascertain the numerical beats of a pulse above two hundred; the pupils are either enormously dilated, or contracted almost to a point; the child is occasionally convulsed; or it lies rolling the head from side to side on the pillow: the eyes half closed, perhaps from paralysis of the levator palpebrarum; by degrees the cornea becomes dim and covered with a slimy deposite; the teeth are ground together; the skin is dry, and burning in some parts, and covered with sweat in another; the feet and hands grow cold; the pulse sinks more and more; the respiration becomes stertorous; and a violent convulsion usually closes the scene.

There are two objects to be attained in this state of the habit: 1, to subdue inflammation in the meninges; 2, if possible to excite the absorption of the fluid which is the result of this previous excitement. With both views, mercurials have been long the standard auxiliaries to the most energetic treatment by other means. Nothing is more difficult than to produce mercurial action in this disease: and if it be effected, little more has been attained than an abatement of symptoms: the convulsions have ceased, and the senses returned; but the patient has, nevertheless, sunk from exhaustion. Mercury was first used in Hydrocephalus, however, with the intention of exciting absorption; and in a few solitary cases this appears to have been the result.

It is difficult to determine the moment for commencing the use of mercurials in Hydrocephalus: it has generally been recommended to commence during the early stage of the inflammatory symptoms, after bleeding and purging. Calomel is the preparation usually preferred. It is given in one or two grain doses, with or without opium, according to the state of the bowels, and repeated every third or fourth hour until its specific influence is displayed. If griping or diarrhœa supervene; the external application of the remedy must be resorted to: but, in general, young children bear it without colic or diarrhœa: and Dr. Clarke asserts that he never saw ptyalism induced in children under three years of age, except in three instances. Some practitioners prefer the Bichloride in minute doses, as it more rapidly affects the habit than Calomel. Dr. Merriman, who uses it, gives from one tenth to one sixteenth of a grain every four hours; and he has succeeded in effecting a cure in *two* instances by this plan. I am of opinion that the method of mercurializing the

habit, by rubbing Calomel on the gums is well adapted for this disease: I have had little experience of its effects; but what I have had speaks in its favour. In whatever form the Mercury is applied, whether by inunction, friction on the gums, or introduction into the stomach, its use must be uninterruptedly pursued: and if a favourable change appear, its administration should never be too abruptly discontinued: but, on the contrary, very gradually relinquished.

Such are the therapeutical advantages to be expected from the employment of the preparations of Mercury as Excitants: like all other potent medicines they may prove salutary or hurtful, according as their employment is directed by the hands of the rash, the ignorant, and the inexperienced, or the well-instructed, the acutely observing, and the judiciously discriminating practitioner.

The preparations of Gold have been much employed on the Continent in Syphilis; and some of those who have ordered them, assert that metallic Gold in a state of minute division, like Mercury, operates upon the habit in the same manner as its salts, and influences the general secerning system. My own experience of the therapeutical effects of the preparations of this metal does not authorize me to offer an opinion upon the subject. They have been prescribed both in Syphilis and in scrofula, and also in bronchocele, and various chronic affections of the skin. Duportal has published one case, which he regarded as cancerous, but which probably was an obstinate case of Lupus, which yielded to the Terchloride of Gold, after it had resisted the usual modes of treatment*.

Creosote† has been lately prescribed as an Excitant, and it has been administered in almost every disease which humanity is heir to; and, as an internal remedy, with a degree of temerity which it is almost fearful to reflect upon. As an external application, it has been found useful in porriginous eruptions; in foul, flabby, sordid ulcers; in leucorrhœa; and in hæmorrhages to which the Creosote, properly diluted, can be topically applied. As an internal remedy in obstinate vomiting, when no inflammatory condition of stomach is present, few medicines allay the irritability of the organ so rapidly as Creosote; but it is of the utmost importance to ascertain the absence of inflammation before prescribing it. In the form of fumigation, it has been employed in Phthisis: but although it has proved beneficial when it has been employed in this manner in chronic Bronchitis, yet, it is scarcely necessary to say that no benefit has ever been derived from its employment in Phthisis.

The only remaining ponderable excitants are Ammonia and Phosphorus, and the remarks which they require are very brief. The influence of Ammonia on the nervous system is rapidly felt

* Ann. de Chem. and Phys. lxxviii. p. 55.
† This substance will be found described under Rubefacients.

without any corresponding vascular excitement; thence it is useful in every instance where aid is required to the nervous energy in depressed states of the habit: even in the decline of inflammatory affections, its beneficial effects are undoubted. Thus, in Pneumonia, when the bronchial tubes are loaded with phlegm, and the powers of the system are unequal to the expectoration required to unload them, it may be given in the form of the carbonate, in doses of from gr. v to gr. xv, repeated at short intervals; or its vapour, largely diluted, may be inhaled. In spasmodic affections, it is one of the best stimulants that can be employed; and in convulsive diseases, depending on, and kept up by increased irritability of habit, its excitant powers are productive of the best effects. But much caution is requisite in using it, even applied to the nostrils in Asphyxia.

Phosphorus, it is scarcely necessary to say, exerts a powerful excitant influeuce; and its action is rapid. This may be demonstrated by injecting Phosphorus dissolved in oil, into the jugular vein of a dog. In an almost inappreciable time, it appears issuing from the mouth in white fumes. The actiou of Phosphorus is that of a diffusible excitant; its action is as transitory as it is powerful. It ought never to be administered, except in extreme cases; such, for example, as *collapse* in Asiatic Cholera, or other similar diseases. On the continent, it has been administered dissolved in ether and alcohol: but the dose of it has not been well determined: and, under all circumstances, it is a medicine of too much power to be placed in the hands of the injudicious or the incautious.

The imponderable excitants are *Electricity*, its modification *Galvanism*, Caloric, Friction, Mental Affections.

Electricity, in whatever manner it is elicited, whether as voltaic or as common Electricity, when applied to the living animal body, operates on the nervous system, causing sensation and muscular contraction, and augmenting secretion. A change is produced in the condition of the nerve through which it is transmitted, and this is most striking when the current of Electricity is couveyed in the direction of its branches, or from its origin to its distribution; a fact which has been amply demonstrated by experiment, and which is not the less true, because powerful shocks of inverse currents, by entering into muscles and affecting some latent recurrent fibrils, produce muscular spasms. There is, indeed, no doubt that even when more powerful, than direct or inverse currents, shocks are much less adapted for producing the usual effects of electricity on muscular contractility: and it is equally undeniable that muscles are stimulated to contraction by the electric current only through the medium of the nerves. It is not necessary for our purpose to examine in detail the truth of the hypothesis which assumes that the nerves in the living body are mere media for the circulation of electrical currents through the body, from the brain and the

spinal cord: which are regarded as ever-acting electrical or Voltaic organs. It is nevertheless true that many animal substances connected by conducting bodies excite phenomena resembling those caused by metals. Humboldt found that feeble contractions are caused "in the leg of a frog, by touching the nerve and the muscle at the same moment with a fresh portion of muscle." The effects, also, produced by electric fishes on animals closely resemble electric discharges: and Dr. John Davy discovered that the electric organs of the torpedo display an electric effect on the galvanometer, and render needles electric. But, notwithstanding these facts, it by no means follows that Electricity is developed in animals by ordinary vital processes. It has, however, been demonstrated that even in *man* there is a certain quantity of *free* electricity; that in a healthy man it is positive; that it is in greater quantity in those of a sanguine than in those of a phlegmatic temperament; that it is greater in the evening than in the morning; that it is increased by stimulants; and that it is negative in women during *menstruation*, and in *pregnancy*.

It may be inquired whether any vital action depends on Electricity? I think we are authorized to assert that no electric currents have been detected in the nerves: and the hypothesis of Dutrochet, that the nucleus of the red particles of the blood act as a negative, and the envelope as a positive galvanic plate, has been refuted. The galvanometer can detect no electric currents in the blood: and notwithstanding the extravagant pretensions of Meissner, who supposed that during respiration the blood became charged with electricity, which was distributed through the pulmonary nerves and the ganglionic system, to the great nervous centres, there is not a single proof in support of the assertion that the nerves are mere conductors of electricity, from the brain over the system. It must not be overlooked that the electric current does not *necessarily* follow the ramifications of the nerves; it is conducted off from them by the neighbouring tissues when these become the media to the negative pole; and that a ligature has no influence in checking its transmission, although the nervous principle is interrupted by it. This fact itself displays the distinction between the nevous and the electrical principle. Nerves, also, when dead, and incapable of exciting action in muscles, are still, like all moist animal matter, good conductors of electricity. Indeed, all recorded experiments prove that "the laws of action of the nervous principle are totally different from those of electricity*."

With regard to the therapeutical employment of Electricity, it is enough to note the fact that the most powerful effects are

* Muller's Phys. Trans. by Baly, p. 640.

caused by transmitting it in direct currents, from the origin to the terminating ramifications of the nerves. With regard to the influence of Electricity on sensation, I cannot accord with the views of Wollaston and Dr. Wilson Phillips, that secretions, such as the milk, the perspiration and the urine proceed from ogans in an electro-positive state, whilst the alkaline, such as bile, and the serous fluids, are the result of the opposite, or an electro-negative condition of the organs: or, in other words, that the influence of the nervous energy over the secretions is merely that of developed electricity; I cannot believe that Electricity excited by substances extraneous to the body, as for instance electrical or voltaic machines, is capable of performing all the functions of the nerves in this particular.

The following experiment of Wollaston, however, is very remarkable.—"He took a glass tube two inches long and three quarters of an inch wide, closed at one end with a bladder, and partly filled with water holding in solution $\frac{1}{240}$ of common salt. The bladder was moistened on the outside, and placed on a plate of silver; a zinc wire connected with the silver plate was then brought into contact with the water; pure soda appeared on the outside of the bladder. But, notwithstanding this singular result, I am of opinion that electricity, however excited, operates as a mere stimulant to the glandular system, differing in its action from other excitants rather in *degree* than in *kind*. I have considered it proper to direct the attention of the reader to these facts, before bringing before him the application of this powerful agent in the treatment of diseases. I have only to add, that, in acting equally on the sensibility and irritability of the system, it differs from other excitants in the rapidity with which its influence is propagated, and in not being followed by those secondary effects which follow the action of almost every other excitant.

Electricity, as an excitant, is indicated chiefly in diseases of *debility, diminished sensation*, and *muscular action, defective secretion*, and temporary *suspension of vital power*.

1. Instances come beneath daily notice, in the course of every man's professional career, in which he finds a general depression of the powers of the habit, and a defect of functional energy, without any very striking disease displaying itself in any particular organ. A middle-aged individual feels himself incapable of the exertion which is natural to his period of life; the function of digestion languishes; the breathing is embarrassed; the urinary excretion is scanty; the skin dry and harsh; or perspiration is profuse, in attempting the smallest exercise; his mind becomes equally depressed; tears flow he knows not why; sleep flies his pillow; and he feels his whole system more and more enfeebled: yet he can fix upon no symptom which points out any particular organ as the seat of the disease.

In such a condition of the habit, both the nervous and the vascular systems are in fault; there seems to be a general defect of nervous energy, co-existent with defective power of the vascular system. There is also a defective supply of blood, or anæmia; hence imperfect secretions, a deficient action of the cutaneous capillaries, and a consequent tendency to other functional derangements. In such cases, that mode of applying the stimulus of Electricity termed the *electric bath* is well adapted. The patient is placed upon an isolated stool, i. e. a stool with glass feet, and is made part of the prime conductor. The Electricity is thus accumulated on his body, and by exciting the peripheral extremities of the cutaneous nerves, we excite indirectly the central organs of the nervous system: thence the animal functions are performed with increased vigour, more especially the circulation of the blood and the cutaneous secretion. In some cases, much benefit has resulted from this mode of employing Electricity; but the success has not been such as to authorize the recommendation of it in treating these attacks of general debility, except as an auxiliary to other methods of treatment. It should be performed daily, and persevered in for at least a month.

2. In no disease has Eectricity, as an excitant, been employed with so much effect, especially in the form of shocks, as in *Paralysis*, when it is not complicated with determinations to the head. In hemiplegia following apoplexy, it is of little avail, unless there is reason to suppose that the effused blood, which almost always occurs in such attacks, is absorbed, and yet the paralysis remains; it may then be advantageously resorted to for rousing again the nerves to those functions which they appear to have lost, in a great measure, from want of use.

In this variety of Paralysis, it is presumed that, as the nerves of the tract of the spinal cord which supply the affected side of the body are those which require to be roused, the shocks ought to be applied along the vertebral column as well as the whole paralysed side.

Those kinds of Palsy in which the beneficial influence of Electricity is most conspicuous, are *general* or *local* Palsy, from cold; that which follows colica pictonum, atonic deafness, and amaurosis. In these cases, the electro-magnetic apparatus is preferable to the common electrical machine: it can be brought into action in any weather; the shocks it gives can be more exactly graduated; and they admit of being more readily directed to organs which it is difficult to bring under the influence of the common electric spark. When used in hemiplegia, the positive wire should be pressed upon the region of the trunk of the paralysed nerves, and the negative upon the point nearest to the place of their distribution. A rapid succession of discharges should then be made.

Thus applied and continued for some length of time, it has frequently been followed by complete success; but it has not equalled the anticipations at first entertained of it. It has been most successful in paraplegia arising from the poisoning influence of Carbonate of Lead; and in *incontinence* of urine depending on paralysis of the sphincter vesicæ.

In atonic deafness, the Galvanic trough should be employed instead of the electro-magnetic apparatus. One wire should be introduced into the meatus of the deaf ear, and the opposite one into the other ear, and, by touching the plates with the opposite end, the circuit may be rapidly broken and completed, so as to affect the paralysed nerves by a succession of regular shocks. In amaurosis, the shocks should pass through the ball of the eye to traverse the retina, or be confined to that branch of the fifth pair of nerves which spreads on the forehead above the orbit, on the condition of which the disease often depends. In aphonia atonica, or palsy of the nerves distributed to the tongue and layrnx, a disc of silver, or a shilling, should be placed upon the tongue, and touched with the negative wire of a battery, the other pole of which is alternately brought into connexion with, and separated from, different parts of the external layrnx.

In cases of defective secretion, Electricity operates as an excitant in two ways: 1, by powerfully exciting the capillaries; 2, by promoting suppuration. By the former mode of acting, in producing a current of blood to the torpid organ, and stimulating its secreting surface, it has been found eminently successful in suppression of the menses from atony of the uterus, accompanied with a pallid, leucophlegmatic condition of the habit. Sparks being passed through the uterus, either from a Leyden jar, or by the interrupted current of an Electro-magnetic machine. In every case of this kind, the possibility of pregnancy as the cause of the suppression should never be lost sight of: and we should, also, recollect that Electricity is not only incompatible when plethora exists, with rigidity of fibre and a sanguine complexion, but that it is extremely hazardous. In this, and in every other case where it is indicated, the strength of the charge should be regulated by the feelings of the patient. Some individuals will sustain with impunity shocks that would prove distressing and injurious to others; perhaps, as a general rule, it is better to trust to moderate skocks long continued, than to hazard the effects of strong charges. "Few cases," says Dr. Percival, "which resist the power of small repeated shocks, yield to great and terrifying ones." Feeble powers ought always to be first tried; these should be gradually augmented, and such as, without producing any violent effects, seem to make a decided impression on the disease when persisted in. Rubefacients, applied at the same time, greatly aid the power of electricity as an Excitant.

Electricity is a most powerful auxiliary in the treatment of Asphyxia, from whatever cause proceeding, to restore the circulation of the blood and the respiratory function. Its influence should, therefore, be directed to the organs upon the action of which these depend: and here the Electro-magnetic apparatus seems to answer better than the Electrical machine. In Asphyxia from drowning, we are advised to lay bare the sheaths which enclose the *par vagum* and the great sympathetic nerve, and to touch the vagum with the wire connected with the positive pole of a battery, whilst one extremity of the negative wire is pressed under the cartilage of the seventh rib. The successive discharges thus succeeding one another with increased intensity and with great rapidity, pass through the lungs, the heart, and the diaphragm, the functions of all of which it is our object to revive. Instead of laying bare the nerves, which is not easily done by every one, and not always necessary, we may use a brush, and, attaching it to the positive wire, press it upon the region of the neck corresponding to their position.

In Asphyxia from hanging, as more or less injury is sustained by the larynx, and sometimes by the spinal cord, electricity is less likely to prove beneficial.

Experiments made upon the lower animals render it probable that it would be highly useful in Asphyxia produced by concussion of the brain, and in poisoning by narcotic drugs. The grounds upon which these opinions are founded are some experiments made on rabbits by M. Goudret, Majendie, and others. In one experiment, a rabbit, which had been to all appearance killed by a few violent blows on the back of the head, was perfectly recovered by a succession of Galvanic shocks, from a trough of thirty couples, continued for half an hour, and passed between the eyes, nose, and meatus auditorious externus, and different parts of the spine of the animal. In repeating such experiments on the human subject labouring under concussion, or suspended animation from drowning or suffocation, patience is indispensable in the operator, as, even in experiments on quadrupeds, the beneficial effects are slowly developed.

In every case, indeed, in which Electricity is likely to prove beneficial, the impatient temper of the sick must be overcome; for it has been justly asserted, that much of the apparent want of success which has followed the employment of Electricity as a remedial agent, has arisen from the defect of time necessary to establish fully the influence of the remedy, and to render its effects permanent.

With reference, also, to the kind of Electricity to be selected; when we desire to operate on the muscles, electric shocks should be employed; but when delicate parts are to be excited, such as the eye, the ear, or similar parts, the Galvanic current should be preferred.

Caloric, between which and Electricity there is much similitude, is one of the vital stimulants. The temperament of the human body is 97·7° or 98·6°, when examined in the mouth or rectum; that of the blood, in health, is about 101°; in disease, it rises to 106° or 107°, or descends to 77° or 79°, as in Asiatic cholera. But the power of generating heat is modified by age; being less in the old and in the very young, than in the intermediate ages. Mr. Edwards has proved that the want of external warmth is a more frequent cause of death in new-born children than is generally supposed. Adults have the power of resisting to a considerable degree the influence of both high and low temperatures. But it is, nevertheless, true that the temperature of the interior of the body is from 2·7°—3·6° Faht. higher in warm climates than in temperate climates*. Much of this is due to the function of the skin, which, in perspiring, carries off heat, and, when dry, prevents it from passing off; as we find in many fevers, in which the heat of the body arises merely from the dryness of the skin.

Although much of the heat generated in the living body depends on the respiratory function, and the living chemistry connected with it; yet other sources of it must be sought for, to explain its formation; and we find *one* in the influence of the nerves in the organic matter of the body; a fact which the experiments of Sir B. Brodie and M. Chaussat have demonstrated. In the experiments of Sir Benjamin, he found that, after injury of the brain, the temperature fell from 104° to 75° before death, which occurred from eleven to twenty-two hours in the animals experimented upon. Chaussat has also endeavoured to prove that the sympathetic nerve has also a considerable share in the production of animal heat. After an injury of the splanchnic nerve, the temperature fell from 104·88 to 78·8° Faht. during ten hours which preceded death. He, also, found that, on applying a ligature to the aorta of a dog, just below where it passes through the diaphragm, the temperature of the thorax was depressed more than that of the rectum; thence he inferred that the influence of the nerves is less exerted in generating animal heat in the thorax than in the abdomen. But numerous objections might be raised to his conclusion from these experiments: they do not, however, interfere with the opinion that the nerves, in the organic processes of the body, greatly contribute to the production of animal heat: a fact which might, a priori, be inferred from the influence of the passions in augmenting or depressing animal temperature. In the *exciting* passions, we find a sudden rush of heat to the face, which is a real augmentation of temperature, not a mere sensation; whilst, on the contrary, the *depressing* passions as rapidly diminish the

* Dr. Davy, Phil. Trans. 1814.

actual temperature of the body. In both cases, however, there is a deference in the usual action of the heart; the mental Excitant acting upon that organ, and through it upon the capillary vessels. The conclusion to be drawn from all these and other facts, which might be brought forward, is, that elevation of temperature taking place in organic processes, is in part determined by the influence exerted in these processes by the nerves. Even man himself, when long acted on by cold, and thus deprived of a vital stimulus, falls back into a state of torpor nearly resembling that of hybernating animals.

If these facts and inferences be admitted, we can have no hesitation in admitting the exciting power of caloric. In employing it as a therapeutical agent, we must bear in recollection that, although it is a vital stimulus, yet, in excess, it rapidly exhausts the nervous energy; and, consequently, it is as destructive as it is beneficial to life.

Caloric, applied in the form of baths, is only excitant when the temperature of the water exceeds 99° Faht.; it then acts both on the nervous and on the vascular systems. Its therapeutical employment is very limited; but, in those cases to which it is applicable, its influence is considerable. The hot bath has been found useful in some malignant fevers, and in agues, when, in extreme exhaustion, the surface is cold, and the state of the skin shrunk, with a concentration of the circulating fluids and the nervous energy in the internal organs. It has, also, been found beneficial in chronic, or old-standing cases of paralysis, when all hazard of the excitant influence of the bath, causing fresh disease in the head, is at an end. It is in such cases that the Bath waters at 104° prove beneficial; and patients thus afflicted are so little susceptible of the stimulus of heat, that they can remain in the bath for upwards of an hour, without suffering any inconvenience. In chronic diseases of the skin, the hot bath is used to excite powerfully the cutaneous capillaries, and to alter the physical and vital condition of the skin. In all of these cases, as the object is the exciting, not the debilitating effects of the bath, the temperature should be as high as the patient can easily bear, and the period of continuing in the bath should be short.

In the local application of hot water, in the forms of *pediluvium* and *manuluvium*, or foot and hand baths, the object being to produce revulsion, the water should be of a temperature sufficient to excite a painful sensation, and produce redness of the skin. In thus exciting the surface, we diminish congestion in the organ which is morbidly affected. Employed in this manner, the hot foot-bath is admirably adapted to relieve the head and the chest in the commencement of catarrh. The mode of employing hot air has already been described.

The application of moxas and the actual cautery might be

supposed, also, to belong to the class of Excitants; but these will more properly be brought under consideration in the class of Epispastics or Erodents.

In every instance in which we employ Caloric as an excitant, we must bear in recollection one fact, which seems to have been altogether overlooked in the application of either hot air or hot water in low states of the habit—namely, that, as it is the vital energy which enables a living animal to resist the destructive influence of high temperatures, when this is low or nearly withdrawn, the body immersed in either of these media is almost in the same state as dead animal matter; and, consequently, instead of being benefited, may be destroyed by the application of either air or water of too elevated a temperature.

With regard to the influence of *mental excitants* there can be no doubt, although their employment as therapeutical agents has been most unaccountably neglected. No man can practise his profession advantageously, however, who does not make himself acquainted with the anatomy of mind as well as that of the body: it is only such that can form an accurate conception of the influence of mental affections on the bodily frame; and how far not only *moral happiness*, but *corporeal health* and *vigour*, depend on the due application of mental energies. It is indeed a theme which might be expatiated upon with advantage far beyond the limits which are here admissible. I shall, therefore, make my remarks of as practical a nature as possible.

In looking at this part of our subject, let us first enquire how far the brain and the other nervous centres are connected with the mental faculties, as, without some degree of information on that point, we cannot found any satisfactory reasoning of the influence of mind upon body, in health and in disease.

Two facts are universally known—namely, that the will is capable of controling the muscular actions of the body in a state of health, and that the mind becomes conscious of impressions, through the medium of the nerves: for, when the nervous communication of a part of the body and the brain is cut off, it is withdrawn from the influence of the will, and impressions made upon it are no longer perceived. But, although volition over the part is lost, and sensation destroyed, yet the organ of the mind, namely, the brain, remains as entire as before; none of the intellectual faculties are diminished in power. On the contrary, lesions of the brain both affect the mind and destroy the powers of the body; and, when organic changes in the nerves cannot be recognized, the mind may be most materially affected and insanity result. These circumstances are sufficient to demonstrate that the brain is the seat of the intellectual faculties; and we conclude that the affections of other parts of the body, including the respiratory and the digestive organs, by passions of the mind, are the result of the mind operating through the

medium of the brain, and, consequently, through that also of the nervous system: the change first takes place in the brain and then upon the other parts of the nervous system.

In admitting, however, that the brain is the organ of the mind, and consequently that its integrity of structure and composition are essential for the demonstration of mind, the action of which must be modified by the condition of the organ, I must accord with the opinion of Muller, that "the mental essence, its latent power, as far as it does not manifest itself, appears to be independent of all changes in the brain"—a remark which, fully understood and accorded in, is at variance with the doctrines of materialism.

The *exciting* passions give rise to convulsive and spasmodic actions of certain sets of muscles; hence the motions of the heart are affected, and the action of the capillaries is augmented. The heart, it has been justly remarked, "stands in the same relation to the mental emotions as the lachrymal organs, which are affected by every emotion of the mind when it reaches a certain intensity*." The conclusion, I may repeat, to be drawn from these facts, is—that the brain, by its organization, is the instrument by which the mind operates; consequently, every emotion of the mind which is capable of exciting the brain must necessarily operate upon the body nearly in the same manner as *material excitants*, acting, as they all do, upon the nervous centres. In this enquiry, it is unimportant for our purpose to investigate whether the brain be the sole seat of mind, or whether other parts of the body do not participate in this office; it is sufficient for our purpose to know that the brain is admirably adapted for transmitting the influence of the mind to the motor apparatus of the body: for *volition* and *passion*, the brain is essentially necessary. Now, this being admitted, a question arises, can mental emotions be made subservient to therapeutical purposes? Let us enquire briefly how it can be answered.

The influence of mental affections in depressing the powers of life is well known: thus, in the navy, even the rude and iron seaman feels its influence. When Scurvy is endemic, the *timid*, the *discontented*, and the *inactive*, have been frequently the *first* to suffer; and *impressed men* newly-draughted are peculiarly liable to it. These depressing feelings operate as sedatives; and hence, not only scurvy, but epidemic diseases and infection, are more rapidly propagated to such individuals. If mind, therefore, has this powerful influence in warding off or producing a predisposition to disease; if it can weaken the vital powers; and, as has frequently been demonstrated, can even destroy life; we have only to look at the analogy, in this respect, between it and

* Muller.

material medicinal agents, to be convinced that the proper application of its powers is likely to prove advantageous in a therapeutical point of view. The mental affections which may be regarded in the light of Excitants are those which, by the suddenness of their impression and the violence of their impulse on the brain, extend their influence to the respiratory organs and to the heart,—namely, pleasurable emotions, *impetuosity*, and, in certain states of the habit, *anger*.

Under many circumstances, Joy has operated as a therapeutical agent. Alexander Trallianus (lib. xii, p. 17) has recorded a case of Melancholia entirely cured by Joy; and Corineous mentions an instance of a tertain being subdued by the same means. There are many instances of its curative influence in the writings of Hildanus and Etmuller. The conditions of the habit in which Joy is most likely to display its salutary exciting influence are those of decided diminished action, such as occur in *Melancholia*, *Hypochondriasis*, and *Chlorosis*. It may be demanded, how the highly pleasurable emotions are to be employed as remedial agents? Now, in reply, let me suppose that a medical practitioner is consulted for the relief of a dyspeptic affection, attended with hypochrondriasis, which he can trace to moral affliction, and disturbance of the nervous system. He finds that the feelings of his patient are quick, sensitive, and powerful; and perpetually harassed by the objects which surround him. His first step should be to remove him from these, and every means, the most powerful which can excite new impressions on the mind, should be adopted to overcome those which have caused, and are keeping up, the disease. The lively sports of the field, if the patient has any predilection for them; scenes of gaiety and animation; news of an agreeable kind; exhilarating conversation; and every exciting feeling of a pleasant description, must be courted and cherished. The mind of the patient must never be left to the regulation of memory; the present impressions must be kept up; and the mind not allowed to be one moment idle. "Idleness of mind," says Butler, the singular author of the Anatomy of Melancholy, "is the bane of body and mind, the nurse of naughtiness, the step-mother of discipline, the chief author of all mischief; one of the seven deadly sins, the cushion upon which the devil reposes, and the great cause of Melancholy." Under the quaintness of the language of this quotation there is the greatest truth. It is not easy, however, to give instructions for the employment of these emotions as therapeutical agents: the tact and judgment of the practitioner must direct the application of the means as they are required and obtained.

It is necessary, however, to remark, in mentioning the employment of the exciting passions in disease, and it must always

be kept in recollection, that, as all ideas productive of them operate as direct excitants to the nervous and irritable fibre, so, when they are excessive, they may, like material stimuli, prove prejudicial to the functions of the body, by the *lassitude* and *languor* which follow their excess. The depressing effects of extreme Joy have been justly referred to determination of blood to the head, which the passion produces, and the consequent exhaustion of the nervous energy. Van Swieten, Boerhaave, and other authors, mention cases of Epilepsy produced by this passion.

Very nearly allied to the pleasurable feelings in their influence upon the habit is that moral courage which sustains the powers of life in diseases, which, without its influence, would prove fatal, however judicious and energetic the treatment of them might be. Fear exhausts the sentient power and the irritability of the living fibre so completely as to produce the most dangerous debility, and even to destroy life. It is, therefore, of the greatest importance in disease to cherish hope, and whatever can exalt the nervous energy.

Many instances might be adduced in which fatal results have followed depression of the mind and the nervous power; and in surgery such cases are not unfrequent when a belief of the fatality of an operation has been impressed upon the mind of the patient by inconsiderate and ignorant relatives. Whereas the contrary influence of courage, in sustaining life, even when the loss of blood from wounds has been very great, is by no means uncommon. Fear deprives the nervous system of its protecting energy; courage aids this conservative power. Hence the salutary influence of raising the spirits and exciting confidence previous to all severe operations; and the same means of sustaining the vigour and energy of the constitution are equally essential in ordinary and general diseases.

In no forms of disease is the therapeutical value of mental excitants so decidedly useful as in Hypochondriasis: in which, with the exception of the necessity of regulating the bowels, no essential nor permanent relief is ever to be anticipated from medicine. The distinguishing features of the disease are mental; and there is a remarkable coincidence between the condition of the mind and the bodily symptoms. The confusion, vertigo, headache, and palpitations; the uneasy feelings under the left breast, and the severe but evanescent sensations of burning in the spinal region; and many other symptoms fluctuate, and are augmented or diminished by the condition of the mind. "The mental chord is struck," says an eloquent writer upon this subject "association is awakened; and the whole chain of disordered feelings of indigestion,—primary and secondary, as uneasiness of the stomach, palpitation, pains and confusion of the head, morbid sensibility and irritability, and a despondency that health and

happiness will never be regained,—will follow*." In such a condition of the nervous system, the first object of the practitioner is to gain the confidence of his patient; to break all old and depressing associations; to rouse by every means his intellectual energies, and to lead his thoughts from himself to whatever is cheering and pleasurable. It is on this principle that travelling becomes so serviceable in such cases: the mind is maintained in a state of constant but pleasurable excitement by the succession of new objects: by abstracting the attention from self, it sooths the pains of sensibility, whilst the pleasurable ideas which it awakens, operating as moderate and salutary excitants, changing the feelings from gloom to cheerfulness, from despair to hope, give a fresh impulse to the nervous energy, and invigorate the body.

A very frequent disease connected with mental depression is nervous Cephalalgia. The pains are generally acute over one, sometimes over both eyes. The brain in such a state is in an irritable, not an inflammatory condition, hence stimulants are indicated; and we find that sometimes even those of a material kind, a good dinner and a glass of wine, will dissipate that which, to a careless observer, would have demanded cupping and other depleting measures. A much more immediate remedy, however, is any event which can rouse pleasurable and cheerful feelings in the mind:—under such, "the irritability and the headach will generally and instantly disappear."

Impetuosity, of which *Anger* is a modification, operates as a most powerful excitant on the nervous system. The impressions which it produces on the nerves are extended to the heart and the arteries; the blood is powerfully propelled to the surface of the body, circulating with rapidity through the most minute vessels, and elevating in a remarkable degree the animal temperature. The face becomes flushed, the eyes sparkle, the breathing is irregular and somewhat convulsed, and as the pulmonary circulation is thus impeded, the veins of the face and of the neck seem ready to burst. It may easily be conceived that the influence of such a state of excitement is hazardous in the extreme, and that apoplexy may be the result. Many cases of this kind are on record. In the debilitated, a much less degree of Impetuosity than amounts to anger may be productive of fatal effects; and it is as useful to demonstrate its deleterious influence, in guarding the debilitated from indulging it, as it is to point out its power occasionally as a curative agent. A gentleman in the advanced stage of Phthisis was visited by an old friend, whom he had not seen for many years: the conversation turned upon an event in which the poor invalid was deeply interested: in relating it, he became much excited, rose from his seat, and dis-

* Fletcher, p. 40.

played an unusual impetuosity of manner: but he had scarcely concluded the narrative ere he sunk into his chair and instantly expired. In this case the excitement exhausted the feeble vital power of the system, and a fatal collapse was the result. Pechlin, in the Third Book of his Observations, mentions the case of an apothecary of such an irascible temper, that, if he had no one to quarrel with, he would grow angry by himself: consequently he was often afflicted with excruciating colic, and at last was attacked with a real tympany, of which he died.

Such is the influence of Impetuosity as a cause of disease, in greatly depressed conditions of the nervous system, when the impression of volition is so inferior to that which is necessary to excite muscular action; the excitement attendant on a paroxysm of impetuous passion may operate as a curative agent. This is not a mere hypothetical opinion: cases are recorded in the *Acta Hafniensis*, and in the writings of *Tulpius*, *Valerius Maximus*, and others, of Palsy being suddenly cured by a fit of anger. But, true as these may be, it is not requisite to recommend Anger as a medicinal agent.

In many painful affections, in which it is necessary to exhaust the sensibility of nerves, the *topical* application of Excitants has been found beneficial; as, for example, in toothache from caries, which is relieved by the introduction of any acrid substance, as camphor or volatile oil, into the hollow of the tooth. On similar principles, the use of local Excitants is indicated in other affections in which pain is a predominant symptom; for example, whitlow, paronychia, in which lotions of alcohol have been found useful; the various species of erythema; and in some of those of herpes. In malignant sore throat, capsicum and some other Excitants form the bases of the most useful gargles.

From the details which have been delivered respecting the influence of the substances arranged in this class of medicines, the importance of Excitants, in a therapeutical point of view, is undoubted; but the very nature of many substances belonging to the class renders them more liable to be abused than those in any of the other classes. Many Excitants are employed as condiments; some of them as our daily beverage; and enough has been said with respect to the general predilection of all nations for diffusible Excitants, particularly wine and ardent spirits, to demonstrate the caution which is requisite in their employment as remedial agents. It is of the utmost importance that the student and the inexperienced practitioner should clearly understand the distinction between Excitants and Tonics, or those medicines which simply increase action and those which are capable of producing a permanent increase of power. It is true that the stimulus which Excitants afford to the nervous system, in a debilitated state of the body, gives a temporary impulse to

the power of the digestive organs, and consequent increase of strength to every part of the frame; but this effect is merely temporary: and the continued employment of the stimulant, instead of maintaining this improved condition of the habit, is soon followed by the directly opposite state, that of exhaustion; indubitably proving that action is not strength. The combination, however, of Excitants and Tonics aids greatly the power of the latter; calling forth, as it were, the strength which the tonics render permanent*.

SECTION III.

SEDATIVES.—MEDICAMENTA SEDANTIA†.

SEDATIVES are substances which directly depress the energy of the nervous system, diminishing action in animal bodies without inducing previous excitement. Regarded in a remedial point of view, they are powers intended to diminish that preternaturally increased action which displays itself chiefly in the circulating system. Whatever may be the cause of this increased action, whether irritating matters introduced into the body, or some condition of its own œconomy, the substances that directly lessen it are Sedatives. They produce their effects by depressing the nervous energy of the brain and that of the spinal marrow. The immediate influence of the administration of a Sedative is experienced first upon the nervous system, and secondly through it upon the muscular: if the dose be large, the individual who has taken it loses his power of volition, becomes vertiginous and staggers; the nerves of sensation cease to respond to ordinary impressions, the person loses consciousness, syncope supervenes, and, in a few seconds, life ceases.

In general, writers on the Materia Medica have confounded Sedatives with Narcotics; from which, however, they are perfectly distinct. It is true that Dr. Young in his Classification has separated them; and Dr. Billing‡ has attempted to mark out the boundaries which separate Narcotics and Sedatives; but he has extended that term to some substances that depress the vital powers only by a secondary influence: thus he regards a dose of salts as a Sedative. Let us examine in what the distinction between these two Classes of medicinal agents consists.

* Besides the substances described in the class of Excitants, the following are also employed on the Continent, and elsewhere: Legusticum *levisticum*, Apium *graveolens*, Scandix *cerefolium* and S. *odorata*, Sisymbrium *nasturtium*, Tropæolum *majus*, Anthemis *cotula*, Matricaria *parthenium*, Epidendrum *vanilla*, Maranta *galanga*, Illicium *anisatum*, Dictamnus *albus*, Ambergris, Nitric and Acetic Ethers, Phosphorus.

† From the Latin word *sedo*, to calm.

‡ Billing, First Principles of Medicine, p. 44.

The administration of narcotics is frequently followed by sedative or depressing effects; but, in every instance, this is the result of previous excitement, which is more or less obvious in proportion to the extent of the dose of the narcotics. In small and moderate doses, Narcotics augment the force and increase the frequency of the pulse, promote the secretions, and bestow a temporary higher degree of both mental and bodily vigour; and, if the narcotic be administered at proper intervals, this excitant effect is maintained. In a short time afterwards, however, the transitory nature of this excitement is conspicuous; and one of depression or collapse follows, in which general languor, dulness of sensibility, and sleep, ensue. When the dose is large, the period of the excitement is so short, that the symptoms of diminished sensibility and motion appear as if they were induced without any previous increased action. This seems to throw difficulties in the way of separating Sedatives from Narcotics; but, as it can be demonstrated, that, even in small doses, no excitement follows the administration of *Sedatives*, there is no doubt that their operation is perfectly distinct from that of Narcotics. To illustrate this point by an example, let us suppose that a moderate dose of a powerful Sedative, hydrocyanic acid, for example, is taken into the stomach: no quickening of the arterial action is perceived; on the contrary, the force and the frequence of the pulse are diminished, and there is a feeling of depression which is too decided to be overlooked. It is, indeed, evident, that this acid possesses a quality directly the opposite of that of an excitant; it exerts a prompt but decisive influence on the nervous system, not only directly diminishing its sensibility, but, if the dose be sufficiently large, also paralysing the whole powers of the nervous centres. This directly depressing power is common to all Sedatives: their effects are an immediate diminution of the powers of life, prostration of strength, stupor, and numbness, lowness of the animal spirits, yawning, sleepiness, vertigo, and, indeed, a complete paralysis of the natural powers of the habit: yet, in the midst of all, the muscular energy is scarcely diminished, and some of the automatic actions proceed, for a short time, when every symptom of sensibility to impression is utterly destroyed.

The admirable experiments of Sir Benjamin Brodie upon sedative poisons explains well the manner in which they act upon the brain through the medium of the nerves; but it is upon the nerves of sensation chiefly that direct sedatives operate; and, therefore, as the motor nerves are but little affected, the organs of respiration continue in some degree their functions; and the powers of the heart also being unimpaired, that organ continues to act, circulating venous blood for some time, as long as respiration can be supported. In Sir B. Brodie's experiments, by maintaining artificial respiration, so as to carry off the superfluous carbon from the blood, it sometimes happened that the

influence of the poison was withstood, and the animals recovered. When Sedatives taken into the stomach, therefore, do not destroy life, their influence is lessened after a certain time; and, sooner or later, according to circumstances, it altogether terminates; the impression, however, may be renewed by a re-application of the means; but it becomes weaker after each repetition, until it almost ceases to act, unless the dose be greatly augmented. It is difficult to explain this fact.

Muller has pointed out a distinction in the mode of action of excitants and narcotics which is applicable to Sedatives. "The contraction of a muscle," says he, "which is thrown into action by an excitant, takes place at the very moment that the excitant affects the nerves; at whatever point of the trunk or course of the nerve it is applied, sensation is excited with equal rapidity. The action of narcotics, on the contrary, which exhaust the sensibility or power of the nerve, extends from its original seat very gradually, and general symptoms slowly follow."

If these statements be correct—and that they are so is undoubted—one inference only can be drawn from them:—namely, that Sedatives act directly on the nerves of sensation, producing a peculiar effect on those parts of the system which are supplied with these nerves; and that this effect is most probably not the result of a stimulus rapidly exhausting the excitability, but of a direct impression of a peculiar kind on the nerves, which immediately deprives them of their susceptibility of receiving impressions from external objects. From the ideas which, at a very early period of life, we obtain of the effect of stimulants as connected with mechanical impressions, it is much less difficult for us to admit the hypothesis, that, in every instance of diminished action from the influence of medicines, there must exist a previous state of excitement, than that something is either abstracted from the nervous energy, or that some alteration takes place in the nerves themselves, which diminishes their power of receiving impressions. No examination of the nerves in animals killed by sedative poisons has demonstrated any change in these organs; and we are necessarily unable to affirm, from appearances, that any thing is either abstracted from them, or that their condition is in any degree altered: yet it is evident that some change has taken place, and that there has been a complete exhaustion of that quality, their excitability, which renders the nerves susceptible of impressions: and we may, however, presume to affirm that the sedative effect is immediate, not secondary. Sedatives, therefore, diminish or destroy excitability; and this in a degree according to the extent of the dose in which they are given; and, by the secondary effect of their direct influence on the nervous system, they lessen, both in point of strength and frequency, the action of the heart and arteries, or extinguish it altogether.

Notwithstanding the powerful action of Sedatives, their

effects in small doses are, in a certain degree, confined to the part to which they are applied: in larger, but still moderate doses, their influence is extended over the system; and it is only in comparatively large doses that they display their poisonous properties, so rapidly destructive of life. In this respect, Sedatives differ from many of the other classes of medicines; their effects being regulated more by the extent of the dose than by the condition of the body.

Having settled these premises, we are prepared to examine the influence of Sedatives on the organs in a state of disease, and to determine how far the effects are to be attributed to the direct influence of the Sedatives, how far to the condition of the body during their employment.

1. *Effects of Sedatives on the Digestive Organs.*—When a sedative substance is introduced into the stomach, in a moderate dose, no particular sensation is experienced; and the certainty that it has operated upon the organ is rendered obvious rather by the effect upon the digestive function which follows, than by any thing which can be referred to the state of the stomach itself. When this organ is morbidly irritable, this diseased state is more or less maintained by the imperfect secretion of the gastric juice reacting upon its nerves, already too susceptible of even ordinary impressions: the influence of a direct sedative, therefore, when admitted into the organ, as it produces an immediate effect upon the gastric nerves, is rendered obvious by the lessened sensibility which follows its administration. The effect is the result of its not only rendering them less susceptible of impression, but, by removing the irritation which is present, favouring the formation of a more healthy, because more slowly secreted, gastric juice, and thus removing one exciting cause of the diseased condition of the organ. That such a local influence may be exerted upon certain sets of nerves, without being sensibly felt by the general system, is undoubted.

If the dose of the Sedative be a little increased, the effect is then extended to the brain, and manifested by slight vertigo, insensibility for a few seconds, sinking of the pulse, failing of the limbs, which the patient most commonly refers to the thighs, general lassitude of the frame, and torpor of the mind. If the dose be large, but still not sufficient to operate as a poison, a sensation of weight and dull pain is felt in the forehead and in the bottom of the orbits. It has been contended that the last-mentioned symptom indicates the existence of excitement previous to the state of collapse which I have described; but this opinion is not tenable, as it is well known that coma may proceed from inanition, as well as from congestion in the brain, and that the administration of stimulants may be requisite for the relief of symptoms closely resembling those which demand venæsection

and depleting remedies. This fact, which I had observed and acted upon many years ago, was first made known to the profession by my friend Dr. Marshall Hall* and Dr. Abercromby†, nearly about the same time; and afterwards by Dr. Gooch‡: and it is now generally acknowledged to be founded upon correct observation.

2. *On the Circulating and Respiratory Organs.*—When the influence of Sedatives which can be taken into the stomach extends beyond that organ, or the surface to which they are applied, their action is frequently displayed on the heart and arteries, by the diminished action of these parts; but this is by no means commensurate with the impression made upon the nervous system. When death occurs, the arteries and the left ventricle of the heart are found empty, the right is gorged with black blood. Schubarth asserts that the heart loses its contractility; but my own experience, and observations drawn from experiments upon the lower animals, incline me to accord with Coullon§, that the heart, the intestines, and the voluntary muscles, retain their contractility in poisoning by powerful Sedatives.

The effects of Sedatives on the respiratory organs depends much on the manner of employing them, whether they be applied directly to the lungs in a gaseous form, or operate through the medium of the stomach. If pure carburetted hydrogen gas be breathed, as was done by Sir H. Davy, the first inspiration caused a sensation of numbness in the respiratory muscles; the second an overpowering oppression of the chest, and in a few seconds an insensibility to external objects; during the third, the person feels "sinking in annihilation‖;" and, if he continue breathing the gas, he dies with a complete destruction of muscular irritability. On examining the lungs, no signs of increased action can be perceived; the organs appear as if their functions had been instantaneously arrested; the blood is fluid and dark-coloured; and things remain as one may suppose them to have been at the moment when the cessation of action occurred. These effects are not those of a narcotic, they are strictly sedative; action is diminished without previous excitement. The influence of all sedatives, however, is not exactly that of carburetted hydrogen. The paralysing influence here extended to the nerves of the cerebro-spinal centres, and was rapidly communicated to the capillary vessels of the lungs; the pulmonary circulation was consequently checked; so that less and less blood was transmitted through the lungs from the venous to the

* Researches on the Effects of Loss of Blood, page 119.
† Account of some Diseases peculiar to Women.
‡ Researches on Diseases of the Brain and Spinal Cord.
§ Recherches, &c. p. 146.
‖ Researches on Nitric Oxide Gas, p. 467.

arterial cavities of the heart; the quantity received by the latter was at length insufficient to support their action; the contractions of the heart therefore ceased; whilst the energy of the brain was suspended. If strong *medicinal* hydrocyanic acid, however, be introduced into the stomach, although the paralyzing influence on the nervous system is the same, yet the heart does not lose its contractility; and the movements of both it and the alimentary canal, which are purely automatic, continue for a short time. The direct influence of Sedatives on the nervous system is thus demonstrated; sensibility, volition, and consciousness are destroyed, whilst muscular contractility still remains; to use the emphatic language of Majendie—"the animal is dead with reference to its external functions, whilst still enjoying life through its nutritive functions."

When taken into the stomach, the influence of Sedatives on the lungs is much less rapid and decisive, their action is greatly modified, but the same effects ultimately take place. The blood ceases to be decarbonized; and in this state, substituted for arterial blood, it displays properties which demonstrate that it operates as a poison on the organs to which it is sent; they are deprived of the power of performing their respective functions; sensibility, irritability, and the physical and vital actions dependent on these, are suspended; the pulmonary capillaries are rendered incapable of transmitting onwards the blood which is sent to them, and this is one of the principal causes of the cessation of the heart's action; at the same time, the diminution of its energy, by the direct action of the Sedative on its nerves, contributes in a great degree to the same effect.

Every circumstance connected with the circulation which produces a tendency to syncope—as, for instance, diseases of the heart, the pericardium, and the large arteries—increases the influence of Sedatives on the vascular and pulmonary systems, and often renders doses which, under ordinary circumstances, would produce little effect, powerful poisons. Loss of blood, also, whether by spontaneous hemorrhage or by the lancet, or other artificial means, augments greatly the power of Sedatives; it is indeed the influence of the loss of blood in causing syncope that enables us to take advantage of it as a sedative power. There are, also, individuals who, from excessive indulgence and other causes, acquire a tendency to syncope determined by the force of habit: such persons cannot bear the influence of Sedatives.

3. *On the Secerning System.*—Little is known respecting the influence of this class of medicines on the secerning system, except on the secreting function of the stomach. In some instances Sedatives appear to operate in a manner at variance with their nature: thus salivation has occasionally followed the employ-

ment of hydrocyanic acid*; and, in other instances, the secretion of urine has been greatly augmented. The latter effect seems to depend on the same circumstances which augment the urinary discharge, when fear and some other mental sedatives influence the habit.

4. *On the Nervous System.*—From what has already been stated, there can be no doubt that it is on the nerves of sensation that sedatives exert their influence; and I repeat, that it is not the result of a stimulus rapidly exhausting the excitability of the nerves, but a direct impression of a peculiar kind on the cerebro-spinal centres which represses or destroys the susceptibility of receiving impressions from external objects. The action in many instances is local, and confined to the nerves of the part. This is proved by the fact, that, when hydrocyanic acid is applied to one limb only of a frog, this member becomes paralyzed, whilst the other limbs remain unaffected. Robiquet, also, while making some experiments on the tension of the vapour of this acid, after having exposed his fingers to it for some time, felt a numbness in them, "which lasted several days†," without experiencing any effect from the acid on his system. In cases of poisoning by Sedatives, however, nothing, either in the brain, the spinal marrow, or the nerves, affords any information of the nature of the impression, except that it is not that of excitement: indeed, this conclusion might have been anticipated from their effects—exhaustion of excitability, and death—without one preceding trace of increased action when administered in large doses‡. Whatever may be the nature of the impression, it is evident that it is different from that of any exciting power, whether the sedative be of a corporeal or a mental nature, or the abstraction of stimulus by blood-letting.

The foregoing considerations, although they afford little which is satisfactory for enabling us to form any accurate conclusion as to the manner in which this class of medicines influence the animal organs, yet confirm the truth of the proposition, that there are powers which destroy excitability and life without previous excitement, or, at least, without any signs of it being discoverable.

Sedatives, from the nature of their effects, may be arranged under two distinct heads—*Direct Sedatives*, or those which operate immediately on the nerves, and *Indirect Sedatives*, or those which operate through the medium of the vascular system.

* Lond. Med. and Surg. Journ. Feb. 1823, p. 128.

† Journ. Complement, v. xxviii, p. 33.

‡ Christison on Poisons, 1st edit. p. 561.

TABLE OF SEDATIVES.

A.—DIRECT SEDATIVES.

* *Organic Products.*

a.—VOLATILE OIL—

Combined with the elements of Hydrocyanic Acid.

Leaves, Flowers, Seeds—	Cerasus *Laurocerasus.*	12.	1.	Rosaceæ.
	* ——— *Virginiana.*	—.	–.	———
	* ——— *Padus.*	—.	–.	———
	* ——— *Capricida.*	—.	–.	———
	Amydalus *communis.*	—.	–.	———
	——— *Persica.*	—.	–.	———
Flowers, Barks, Roots—*	Pyrus *aucuparia.*	12.	3.	———

b.—NICOTINA—

Combined with Volatile Oil.

Leaves——— ———	Nicotiana *Tabacum.*	5.	1.	Solanaceæ.

* * *Inorganic Substances.*

c.—SULPHUR—

Combined chemically,

a. with Hydrogen.

b. ——————— and Ammonia.

d.—CARBON—

Combined chemically,

a. with Hydrogen.

B.—INDIRECT SEDATIVES.

A.—PONDERABLE AGENTS.

a.—CARBON—

Combined chemically,

a. with Oxygen.

b.—CYANOGEN—

Combined chemically,

a. with Hydrogen.

b. —— Potassium.

B.—IMPONDERABLE AGENTS.

a.—BLOOD-LETTING.

ORGANIC VEGETABLE PRODUCTS WHICH OPERATE AS SEDATIVES.

VOLATILE OILS AND THE ELEMENTS OF HYDROCYANIC ACID.

* *Leaves, Flowers, Seeds.*

CHERRY LAUREL.—*Prunus Lauro-cerasus.* E. D.—This plant has lately been removed to the genus Cerasus, which differs in very few particulars from the genus Prunus. The chief distinction is the globular form of the nut, and the disposition of the leaves, which are folded flat, not rolled up in the bud as in Prunus.

The Prunus or Cerasus *Lauro-cerasus* is a native of the coast of the Black Sea, although it is now common in gardens every where in Europe, into which it was brought about the end of the sixteenth century. It belongs to the natural order Rosaceæ—sub-ord. Amygdaleæ*. It is a small ever-green tree, with deep-green, oblong, acuminate, short-stalked leaves; recurved at the apex, serrated, coriaceous, shining, with 2 or 4 small yellow glands at the base on the under side. The flowers are in axillary racemes; the fruit a round black drupe, in size and appearance resembling a small black cherry. The volatile oil and the constituents of hydrocyanic acid reside in the leaves and the kernels of the fruit. The flowers, as well as the leaves, have the odour and taste of the Bitter Almond and the kernel of the Peach, and communicate them readily to boiling milk, cream, diluted alcohol, and other substances; in which the leaves are employed as condiments. The *leaves* are the parts officinally employed, or rather the water distilled from them, the *Aqua Lauro-cerasi.* E. D.—It is prepared by distilling a pound of the fresh leaves, chopped small, in two pints and a half of water, until one pint passes over, filtering, if any milkiness remain after a few seconds of rest, and then adding an ounce of compound spirit of Lavender. The volatile oil with which the water is impregnated is a Hydruret of Benzule†, combined with Hydrocyanic acid. The distilled water has the grateful odour of the peach kernel, which can be readily distinguished from the peculiar odour of the hydrocyanic acid. According to Goppert, it contains 2·75 per

* Woodville's Medical Botany, third edition, p. 513, pl. 185. Richard, Hist. Nat. Med. t. ii, p. 446. Lindley, 232.

† Hydruret of Benzule is a compound of C. 14, H. 5, O. 2, + H. equiv. = 107.68.

cent. of hydrocyanic acid; but I am inclined to think that this proportion is overrated.

The oil itself closely resembles that of Bitter Almonds; indeed, according to Robiquet, it is in every respect the same*. It is of a straw colour, sp. gr. 1.836; it attracts oxygen from the air, and, when long kept, deposites benzoic acid.

The leaves and kernels of other species of cherries—namely, the cluster Cherry, Cerasus *Padus*, an indigenous species†; Cerasus *capricida*; C. *Virginiana*; the Peach, Persica *vulgaris*; the *Sloe*, Prunus *spinosa*; the *Bullace*, Prunus *institia*; even the leaves and kernels of the common Cherry; and the flowers, bark, and root of Pyrus *aucuparia*, yield a similar distilled water; but, in them, both the oil and the elements of hydrocyanic acid are in smaller quantity than in the leaves of the Cerasus *lauro-cerasus*.

As the strength of this distilled water varies, it is difficult to determine the exact dose. It is preferable to commence with f℥ss, and gradually increase the dose to the extent which the stomach will bear.

Laurel water was formerly much employed as a sedative: its influence depends solely on the hydrocyanic acid it contains‡.

THE BITTER ALMOND. *Amygdala amara*. L. E. D.—The Bitter Almond is the kernel of the fruit of the variety *amara* of the Amygdalus *communis*, a tree which is a native of Barbary and Syria, but is now cultivated in Europe§. The Sweet and the Bitter Almond are produced on trees so closely resembling one another, that they are regarded as varieties of the same species; and it is asserted that the Sweet Almond tree yields Bitter Almonds when neglected; the Bitter Almond tree Sweet Almonds when it is cultivated with care‖. The fruit of the almond tree is a leathery, downy, ovoid drupe, with the sarcocarp spontaneously dropping off the putamen, which is oblong, or ovate, and acute, with the shell either hard or soft. That of the Bitter Almond is hard and brittle; the kernel, or almond, is ovate, compressed, thick and rounded at one end, and thin and pointed at the other. It is smaller than the Sweet Almond, has an extremely bitter taste; and, when bruised in water, exhales the agreeable odour of the peach-blossom. The Bitter Almond contains, according to Vogel, 28 per cent. of bland, inodorous, insipid fixed oil, which is procured by expression. When the marc, which remains after the almonds have been subjected to

* Journ. de Pharm. viii, p. 304.

† The Kirschwasser of the Germans is obtained from that cherry.

‡ Several fatal cases have at different times occurred from the use of a liquor called Ratafied Brandy, which is prepared with it.—See Phil. Trans. 1837; Fodoré, Med. Legale, iv. 27; Apparatus Medicam. iii, 216.

§ Woodville's Med. Bot. third edit. p. 507, pl. 183. Richard, Hist. Nat. Med. t. ii, p. 448. Lindley, 231.

‖ Murray's Apparatus Medicaminum, vol. iii, p. 257.

the press, is distilled in water, a pale golden-yellow volatile oil is obtained, acrid and bitter to the taste, and exhaling the odour of the peach blossom. It is combustible, burning with a white flame; is heavier than water; sp. gr. 1.08; and is distinguished from other volatile oils by its rapidly absorbing two parts of oxygen, and the formation of crystals, which are benzoic acid*. It is soluble in alcohol and ether; is reddened by sulphuric acid, and when agitated with water, that fluid is found to contain hydrocyanic acid: it is, therefore, like the oil of the Cherry Laurel, a compound of two distinct substances,—namely, Hydruret of Benzule and Hydrocyanic Acid. Neither the Bitter Almond itself, nor its residuary cake, contains either the volatile oil or the hydrocyanic acid: for when they are digested in strong alcohol, amygdalin is taken up, but neither volatile oil nor hydrocyanic acid, although both are soluble in it; and the residue is incapable of yielding either by distillation with water. The constituents of both are contained in the amygdalin†, which, however, requires to be acted upon by emulsin and water before the oil and the acid can be developed‡. That the amygdalin is the source of the volatile oil and the hydrocyanic acid, is demonstrated by the fact, that the residue of the digestion of almond cake in ether, which does not take up amygdalin, is still capable of yielding both the oil and the acid by distillation with water.

The fact that this volatile oil contains hydrocyanic acid is easily proved by digesting it with peroxide of mercury, which is converted into the bicyanide of that metal. The same fact is also demonstrated by distilling the oil with pure potassa and sulphate of iron. A limpid, colourless oil, having a powerful odour of peach blossom, passes over, and Prussian blue remains in the retort. The oil contains not a trace of hydrocyanic acid. When the volatile oil of bitter almonds is distilled, per se, the portion which comes over first has less of the peach-blossom odour, but more of that of hydrocyanic acid than the oil itself before distillation; whilst the residue in the retort, which has acquired a high red

* Ann. de Chimie et de Phys. t. xliv, p. 378. In this case, half of the oxygen combines with the hydrogen of the oil and forms water, which remains in the benzoic acid.

† *Amygdalin* is not found in the sweet almond. It is a white, inodorous substance, impressing a sweet and then a bitter taste on the palate. It is insoluble in cold water, soluble in hot water and in hot alcohol, but not in ether. It is a compound of 40 eq. of Carbon, = 244·8, + 27 Hydrogen, = 27, + 22 Oxygen, = 176, + 1 Nitrogen, = 14·15, equiv. = 461·95; or of 56·516 C. + 5·908 H. + 38·512 O. + 3·064 N. = 100·000. Journ. de Pharm. t. xxiii.

‡ *Emulsin* is found in both sweet and bitter almonds. It is white, inodorous, insipid, soluble in cold water, but insoluble in alcohol, which precipitates it from its aqueous solution. Its watery solution coagulates at 212°, and forms a mucilage. Its constituents are—25 eq. of Carbon = 146·88, + 23 Hydrogen, = 23, + 9 Oxygen, = 72, + 4 Nitrogen, = 56·60, equiv. = 298·48; or, 48·8 C. + 7·79 H. + 24·4 O. + 18·99 N. = 100·00. Manson, Organic Chem. p. 683. Wolsler and Leibig, Journ. de Pharm. t. xxiii.

colour, scarcely smells of hydrocyanic acid, although it retains much of the odour of the peach-blossom. By repeating the distillation of what remains in the retort for a short time, the residue retains not a trace of hydrocyanic acid; but it instantly crystallizes on exposure to the air. These crystals have acid properties: they are soluble in boiling water; they crystallize out of it on cooling; are fusible, volatile, unite with alkalies, are not poisonous; and, in fact, present no analogy with the oil from which they are procured. They are a compound of 1 eq. of Benzule (the base of the volatile oil of the oil of bitter almonds), = 106.68, + 1 of Oxygen, = 8, equiv. = 114.68.

The water with which the residuary cake of the Bitter Almond, after expression of the fixed oil, is distilled to procure the Volatile Oil, retains a portion of the Hydrocyanic Acid and the odour of the oil: consequently it possesses the same chemical qualities as Cherry Laurel water, and the same powerful sedative properties.

The baneful effects of Bitter Almonds, eaten in large quantities, were observed at a very early period. Dioscorides states that this almond was employed for killing wolves; but it was not known, until a German chemist, Bohm, ascertained the fact, that its baneful influence depends on the presence of hydrocyanic acid. Besides affecting men, it acts powerfully on quadrupeds, causing tremors, palsy, convulsions, coma*.

When Bitter Almonds are eaten in a large quantity, they prove poisonous and often fatal. The symptoms are nausea, vomiting, sometimes purging, insensibility, and convulsions; effects which are due chiefly to hydrocyanic acid, which is evolved, during their mastication, by the water of the saliva†. Owing to a peculiar idosyncrasy, the smallest portion of them cannot be taken, by some persons, without their suffering from sickness, vomiting, and the appearance of an eruption closely resembling nettle-rash; an effect which they caused on the late distinguished Dr. James Gregory. The emulsion, ratifia cakes, and similar confectionery, it may readily be supposed, will operate in the same manner on those similarly predisposed. An instance of the risk of eating much ratifia cake occurred in a young boy whom I was called to see. He remained in a precarious state for two days.

The *Volatile Oil of the Bitter Almond* operates as a sedative, almost as powerfully and as rapidly as the hydrocyanic acid. Some experiments were made with it by M. Jorg and others, at Leipsig. They took it in doses, progressively increased, from

* Bibliotheque Germanique, t. i, p. 102. Ann. Cliniques de Montpellier, t. i, p. 227. Journ. de Pharm. t. ii, p. 344. Wirk. d. Arzneim, ii, Gifte, i, p. 157. Orfila's Toxicolog. Gen.

† For cases illustrative of this fact, see Lond. Med. and Phys. Journ. vii, p. 150. Coullon, Recherches sur l'acide hydrocyan. 60, 1819.

five to twenty-five minims, and finally to a hundred and twelve minims! The symptoms were those of concentrated action on the brain, sense of weight in the head, sleepiness, torpor of the intellectual functions, lassitude, feebleness, retardation of the pulse, and headache. This last symptom was preceded by a dull, pungent pain in the region of the optic nerves. It likewise brought on a slight attack resembling bronchitis. M. Jorg refers these symptoms to the turgescence or plethora of the vessels of the brain; but they may arise from paralysis of that organ. When it is taken in large doses, the poisonous influence of it is almost instantly perceived. Recoveries, however, have been more frequent than after full doses of hydrocyanic acid, which can be attributed only to the variable quantity of that acid which the oil contains; and the stimulant influence of the oil itself counteracting the sedative action of the acid. In a case related by Mertzdorff*, where f℥ii of the volatile oil were taken, death did not occur until half an hour after the dose was swallowed: and in one case, recovery occurred after half an ounce of the oil had been taken.

The post-mortem examination of the body displays a gorged state of the cerebral vessels; the whole body exhales a strong odour of peach-blossom; and decomposition proceeds rapidly. There is more redness of the mucous membrane of the stomach and intestinal canal than in poisoning by hydrocyanic acid.

b. NICOTINA WITH VOLATILE OIL.

* *Leaves.*

TOBACCO. *Tabacum.* L. E. *Nicotiana Tabacum: folia.* D. —Tobacco is the dried leaf of the Nicotiana *Tabacum*, a plant, belonging to the natural order Solanaceæ†. It is a native of South America, but is now extensively cultivated in Virginia in the United States. It is an annual, rising from five to six feet in height, with an erect, round, hairy, viscid stem, branching at the top. The leaves are large, sessile, ovate-lanceolate, acuminate, viscid, and of a pale green colour. The flowers are in terminal panicles, with linear, acute bractes. The calyx is glutinous and hairy; the corolla funnel-shaped, tipped with rose-colour; the ovary ovate; the style long and slender, and the stigma cloven. The seeds are numerous, reniform, brown, in a bilocular capsule. In the month of August, the plants are cut down, and, after being dried in the shade, the leaves are stripped off, tied in bundles, and sent to Europe in casks.

* Journ. Complement, &c. xvii, 366.

† Richard, Hist. Nat. Med. t. ii, p. 101. Lindley, 513. London Dispensatory, art. Nicotiana *Tabacum*.

The dried leaves of the Virginian Tobacco, the only officinal kind*, are of a clear brown colour, have a peculiar, well-known odour, and a bitter acrid taste. The expressed juice has been analysed by different chemists: the following is that of Posselt and Reinmann: 0·06 *Nicotina*, + 0·01 *volatile oil*, + 2·87 *bitter extractive* + 1·74, *gum with malate of lime*, + 0·267 *Chlorophylle*, + 1·308 *Albumen* and *Gluten*, + 0·51 *Malic acid*, + 0·734 *Salts*†, + 0·088 *Silica*, + 88·280 *water*, + 4·969 *lignin*, = 100·836. In this list, the Nicotina and the Empyreumatic Oil, with the bitter Extractive, are the only constituents which can be regarded as active; and they are extracted from the dry leaves, in making the Infusion and the Wine. In smoking Tobacco, or distilling it per se, an empyreumatic oil is obtained which exerts a powerful sedative influence on the system; and consequently it is required, also, to be noticed here.

1. *Nicotina*.—This substance which is regarded as the active principle of Tobacco in its natural state, exists in the leaves, the seeds, and the rest of the plant. It may be procured by a process suggested by Vauquelin‡. It is a nearly colourless, volatile fluid, having the acrid burning taste and the peculiar odour which distinguish Tobacco, and it causes violent sneezing when snuffed up the nostrils. It gives an alkaline reaction with turmeric; reddens vegetable blues; and combines with acids forming salts, some of which are crystallizable. It becomes brown, thick, and is decomposed by exposure to the air, and it is also decomposed at its boiling temperature, namely, 375°. According to Thomson, Virginian tobacco yields 10·00, Maryland 5·28, of Nicotina in 1000 parts§. It is soluble in water, ether, alcohol, fixed and volatile oils; and approaches in its chemical properties to the volatile alkalies. It is precipitated from its solutions by tincture of gall-nuts, which also throws it down in the infusion of tobacco leaves.

2. The *Concrete Volatile Oil* obtained by distilling the leaves with water, has the odour of tobacco, and a bitter taste. It is soluble in ether and caustic potassa; but insoluble in water and dilute acids. It causes a sensation on the tongue and in the throat similar to that of tobacco-smoke. Applied to the nose, it causes sneezing.

3. *Empyreumatic Oil of Tobacco*.—This oil is produced in the ordinary process of smoking, which is a kind of destructive distillation; and by distilling the leaves without water. It is

* Many other Tobaccos are known in commerce; namely, the *Maryland*, *Kentucky*, and *Carolina*: *Havannah*, the produce of N. *repanda*; the *Columbia*, *Orinoko*, *St. Domingo*; the *Varinas*, and *Porto Rico*, which are in rolls: the *East Indian*, the *Manilla*, and the *Shiraz*, N. *Persica*.

† These salts are sulphate, nitrate, and malate of Potassa, Chloride of Potassium, Phosphate and malate of lime, and malate of Ammonia.—Gmelin, Handb. d. Chem. vol. ii. p. 1303.

‡ Ann. de Chimie, tome lxxiv.

§ Organic Chem. p. 286.

semifluid, of a deep brown colour, and has the odour of tobacco-smoke, with a bitter, acrid taste.

The experiments of Sir B. Brodie demonstrate that this Empyreumatic Volatile Oil operates directly on the brain and nervous system, and the general sensibility of the habit, in a manner similar to hydrocyanic acid; the Nicotina and Concrete Oil, which appear to act chiefly through the motor nerves, exert their influence particularly on the heart, which they paralyze, and thereby cause death. In whatever manner these oils are procured, they are extremely virulent in their influence upon the animal œconomy, so that instantaneous fatal effects follow their introduction into a wound.

The energetic nature of Nicotina is such, that, when swallowed in doses of a grain, the action of the heart ceases even before that of the diaphragm.—It is the presence of the oil, however, which renders the smoke so powerfully sedative.

When a person unaccustomed to smoking takes a pipe for the first time, he soon becomes sick and vomits, the force of the circulation is reduced, great muscular debility, vertigo, insensibility, and cold sweats, supervene; and a considerable period elapses before he regains his former healthful feelings. Nearly the same symptoms follow the application of a strong infusion of Tobacco to the scalp, or, in the form of cataplasm, to the pit of the stomach; or still more severely when it is applied to an abraded surface; in some instances death has followed in a few hours.* Similar results follow if the infusion or the smoke be thrown into the rectum†: and cases are recorded in which the infusion, made with ʒii‡, ʒi, and even ʒss§, of the leaves in f℥viii of water, has proved fatal.

In Sir B. Brodie's experiments, it appeared that the Infusion of Tobacco destroys the sensibility of the heart, but not its muscular contractility: as it is, however, incapable of being excited by the stimulus of the blood, its action ceases, and at the same time the nervous energy of the brain is destroyed; and this leads us to infer, with Sir B. Brodie, that the infusion influences the heart through the medium of the nervous system; as that organ becomes insensible, and syncope ensues||.

Such is the physiological action of Tobacco,—that of a direct sedative. When it produces its deleterious effects, like hydrocyanic acid, it operates too instantaneously on the nervous system to admit of the employment either of the stomach pump or of emetics; we must therefore have recourse to some chemical reagent to render it inert; and at the same time we must rouse the

* Med. and Phys Journ. xiv. p 305.
† Barbier, Mat. Med. t. iii, p. 456.
‡ Cooper (Sir A.) on Hernia, p. 24. Bell's Surgical Obs. part ii, p. 189.
§ Copeland's Dict. of Pract. Med. art. Colic.
|| Edin. Med. and Surg. Journ. xiii. p. 455–6.

depressed powers of the system. The best substance for fulfilling the first indication is the infusion of nut-galls, or of any other vegetable astringent; the effect of the tannic acid is the formation of a Tannate of Nicotina, which is insoluble and inert. To fulfil the other indication and support the vis vitæ, brandy, ammonia, and other stimulants, must be resorted to; and, bearing in recollection the effects of artificial respiration in the experiments of Sir B. Brodie, there is every reason for supposing that this method of maintaining the function of the lungs might prove beneficial, if an admixture of oxygen gas with common air were used. I feel the force of an objection which may be raised in this case:—it may be stated that artificial respiration is useful only when the lungs and heart do not share in the shock given to the sensitive part of the frame, as in cases of poisoning by hydrocyanic acid; at the same time, I know that, by stimulating the heart and pulmonary system, the nerves supplying them may be again roused into activity*.

Tobacco is administered in the form of Snuff, *Smoke*, *Infusion*†, and *Wine*‡: the two last only require to be noticed in this place.

The *Infusion*, in the London and Dublin Pharmacopœias, is ordered to be made with ʒi of Tobacco to Oi of boiling water. In the Edinburgh, gr. xv. to ʒss to ℥viii. In all of these formula, the quantity of the Tobacco is too great, except in the minor quantity of the Edinburgh formula, which is adequate for every thing that can be expected from the Tobacco Enema, for which the Infusion is chiefly employed.

The *Wine* of the Edinburgh College is made by digesting three ounces and a half of Tobacco in two pints of Sherry, for seven days, strongly expressing the residue and filtering the wine. The dose is m. x to m. xlviii.

INORGANIC SUBSTANCES.

c. SULPHUR WITH HYDROGEN AND WITH AMMONIA.

Pure Sulphur exerts no depressing influence on the animal œconomy; but some of its combinations are powerful Sedatives: two only of these require to be noticed.

a. SULPHURETTED HYDROGEN GAS—HYDRO-SULPHURIC ACID.—This gas, in combination with aqueous vapour, is exhaled from sulphurous springs and baths. It may be artificially pre-

* See *G. Neander*, Tabacologia, Lugduni-Batav. 1662. *Stahl*, de Tabaci effectibus, &c Erfodiæ, 4to. 1732. *Fowler*, On the Diuretic Effects of Tobacco, &c. Lond. 1785. Journ. de Pharm. 1815. *Pointe*, *J. P.* Obs. sur les Maladies auxquelles son sujets les Cuvriers, &c. Paris, 1818.

† Infusum Tabaci, D. Enema Tabaci, L. E. ‡ Vinum Tabaci, E.

pared by acting upon Protosulphuret of Iron* with Sulphuric acid, diluted with three or four parts of water; or by heating one part of Sulphuret of Antimony in a retort, with four or five times its weight of Hydro-chloric acid. In both instances Sulphuretted-hydrogen gas is evolved, while the metal is changed into a protoxide and unites with the sulphuric acid. The oxygen and the hydrogen evolved are obtained from the decomposition of a portion of the water.

Sulphuretted-hydrogen gas thus procured is colourless and elastic, like common air; it has a fœtid odour, resembling that of putrefying eggs; its taste is also nauseous, and slightly acid: its specific gravity is 1·1805; 100 cubic inches weigh 36·6074 grains. It becomes a liquid under a pressure of 17 atmospheres, at 50° Faht. It is rapidly absorbed by water: 100 cubic inches of water taking up 253 of sulphuretted hydrogen gas, and the solution reddens litmus. It does not support combustion; but, when set on fire, it burns with a bluish-red flame, and deposites much sulphur. It explodes when one measure of it is mixed with one and a half of oxygen gas, and fired; water and sulphurous acid being formed. It is evidently sulphur, acidified by hydrogen; and consists of Sulphur 94·1, + Hydrogen 5·9, = 100·0, or S. + H., equiv. 17·1. It is readily decomposed by chlorine, which, uniting with the hydrogen, forms hydrochloric acid, and sulphur is deposited: with sulphurous acid, a mutual decomposition takes place, water is formed and sulphur deposited; with iodine, its hydrogen is attracted to form hydriodic acid, whilst sulphur is deposited.

This gas is extremely deleterious to animal life, even when much diluted. MM. Thenard and Dupuytren ascertained that an atmosphere of common air, holding 1-800th of it†, will quickly kill a middle-sized dog: and Professor Chaussier ascertained that it proves fatal even when merely applied to the skin or to the mucous membrane in a concentrated state; a rabbit, whose skin only was exposed to it, died in ten minutes; and a horse, into whose anus ten quarts were injected, died in one minute‡. Workmen employed to empty privies and drains often suffer from this gas, becoming suddenly weak and insensible; and, if the gas be concentrated, they fall down and suddenly expire§.

* *Ferri Sulphuretum*, E. D. Protosulphuret of iron is readily procured by exposing to a low red heat a mixture of three parts of iron filings and one part of sulphur in a Florence flask, or a common earthen crucible fitted with a cover. Or, according to the Pharmacopœias, by rubbing a roll of sulphur upon an iron rod heated to a full white heat in a forge, and catching the fuzed globules of the sulphuret in a vessel full of water.

† Orfila's Toxicologie Générale, t. ii. p. 479.

‡ Sedilott's Journ. de Med. t. xv, p. 28, 34.

§ No drains nor pits of necessaries should be entered by nightmen until the presence of this noxious gas be determined, by first letting down into them a piece of paper rubbed with white lead. If this become brown or black, there is risk in descending into these places.

If the gas be much diluted, either coma or delirium, followed by tetanic convulsions, succeeded by a cold, clammy skin, feeble, irregular pulse, and frothing at the mouth, takes place. Post-mortem dissections of persons thus killed, exhibit a black, thin state of the blood; the loss of the contractility of the muscles: and a putrescent odour of the whole viscera; and white lead, thrust under the skin, is immediately blackened.

In cases of asphyxia by this gas, water should be dashed on the chest, and artificial respiration employed; if the person revive, Ammonia and other stimulants should then be administered.

I am not aware that this gas, or its solution in water, has ever been used as a therapeutical agent, although its inhalation in Phthisis has been suggested: but the greatest caution is requisite to prevent its dangerous effects; and this will always operate as an obstacle to its general employment. I have noticed it here chiefly to afford an opportunity of mentioning the following fact. Much of the depression which occurs in those diseases which are termed nervous, and in febrile affections of a low kind, seems to depend upon the extrication of large quantities of this gas in the intestinal canal, indicated by the offensive odour of the fæces, closely resembling that of the gas, and also by the blackening of slips of paper rubbed with carbonate of lead, when held over the vessels containing the fæces. Solution of chlorine, or of the chloride of soda, should be administered in these cases.

b. HYDRO-SULPHURET OF AMMONIA. *Ammoniæ Hydrosulphuretum.* D*.—This combination of Sulphuretted Hydrogen and Ammonia is readily prepared by passing a stream of Sulphuretted Hydrogen gas through a solution of pure Ammonia. It may be procured in a dry state by the direct union of its constituent gases: if they be passed into a glass globe kept cool by ice, the Hydrosulphuret is deposited in crystals on the sides of the globe. It is also formed during the natural decomposition of animal matter. The officinal preparation is of a green colour; has a very fœtid odour, and an acrid, pungent taste. It attracts, powerfully, the oxygen of the atmosphere, and thus undergoes decomposition; consequently it ought to be preserved in small bottles, well stopped, and kept full. It is decomposed by mineral acids, and sulphur is precipitated, whilst sulphuretted hydrogen gas is evolved. The salts of Lead, Silver, Copper, and Bismuth, are blackened by it; those of Antimony are converted into the orange sulphuret; and the Arsenious acid into the yellow sulphuret; they are therefore incompatible in formula with it. When the ammonia is not neutralized, it renders turbid the sulphate of magnesia in solution. It

* This Hydrosulphuret is supposed to have been first prepared by Boyle:—henc one of its names—"Boyle's fuming liquor."

consists of 50 parts of Sulphuretted-hydrogen, + 50 of Ammonia, = 100, or of 1 eq. of Sulph. Hydrogen = 17·1, of Ammonia = 17·15, equiv. 34·26.

As a Sedative, it lessens the action of the heart and the arterial system, by acting directly on the nervous energy; and, even in moderate doses, it causes nausea, vomiting, drowsiness, and vertigo. Mr. Cruikshanks proposed its use in diabetes mellitus, with the view of diminishing the morbid action of the digestive organs.

The dose is m. v in a tumbler of water, taken immediately it is dropped, three or four times a day, increased until vertigo occur.

e. CARBON WITH HYDROGEN.

Carburetted Hydrogen Gas.—Carbon, like Sulphur, acquires sedative properties by combination. The gas now under consideration is abundantly exhaled from the surface of stagnant pools; and it forms the greatest part of that gas which escapes from the crevices in coal mines, and is well known to miners under the name of *fire damp*. The common coal gas burnt in our streets is a mixture of this gas with Olefiant gas.

Carburetted hydrogen gas possesses all the physical properties of common air; it is colourless, tasteless, inodorous. Water absorbs about $\frac{1}{60}$ of its volume. Its specific gravity is nearly $\frac{1}{2}$ of that of common air, or 0·5554; and it is highly elastic. 100 cubic inches of it weigh 16·94 grains. It is a compound of 1 of Carbon = 6·12 + 2 of Hydrogen = 2; equiv. 8·12. It is unable to support combustion or respiration; but it is inflammable, burning with a clear, yellow flame. When mixed with certain proportions of atmospherical air, or with oxygen, and ignited, it explodes violently, producing carbonic acid and water; and it is this admixture which explodes and produces such fatal consequences to miners.

Except sulphuretted hydrogen, this is the most deleterious Sedative to animal life; producing, when taken into the lungs, even in a diluted state, almost instantaneous death; and so complete a destruction of nervous energy, that animals thus destroyed cannot be recovered under any circumstances. When a person inspires it, even combined with three times its bulk of oxygen, he becomes sick; his lips turn livid; his pulse instantly sinks; and, on the third inspiration, the irritability of the lungs is destroyed. In cases where death does not ensue, from the large dilution of the gas, the consequences of breathing it are felt for twenty-four hours. Notwithstanding these effects, miners, accustomed to it, breathe it in a diluted state with impunity—a fact which demonstrates how soon the habit gets accustomed to deleterious atmospheres.

This gas has been employed for medicinal purposes, as a

Sedative, diluted with 20 or 30 times its bulk of common air. In this state of dilution, it cannot be respired for more than a few minutes at a time, as it causes nausea, dizziness, and symptoms of great depression. It has been employed in Phthisis. Its obvious effects are those already stated; it also diminishes pain. When employed, it should be at first diluted with thirty times its weight of atmospherical air, and the quantity of common air gradually reduced to twenty times the bulk of the Carburetted-hydrogen gas.

INDIRECT SEDATIVES.

These are comparatively few in number; and although their influence is felt upon the nervous system, yet it is more immediately experienced by the circulating medium, operating either by altering its properties so as to unfit it for affording a due stimulus to the brain and nervous centres, or diminishing its quantity so as to cause a similar state of the brain from defect of excitement, or, as it were, from inanition.

A. PONDERABLE AGENTS.

a. CARBON WITH OXYGEN.

*Carbonic Acid Gas**.—This gas is found under a variety of circumstances: it issues from the earth, as in the Groto del Cane, near Naples; in the gas baths of Franzensbad and Marienbad; in the valley of Poison in Java, where a cavity, three quarters of a mile in circumference and thirty-five feet deep, is filled to the height of eighteen feet with it; and in the vicinity of the Lake of Laach, where the exhalation of it has been estimated by Bischof to be 219,000,000lbs, or 1,855,000,000 cubic inches annually. It is formed in many common operations; in burning fuel; calcining limestone; and fermenting liquors; it is exhaled in the dark by plants, and expired, at all times, from the lungs of animals; it also accumulates in mines and in wells that have been long out of use, and in old, ill-ventilated cellars. It is easily procured for medicinal purposes by acting upon white marble (carbonate of lime) by means of hydrochloric acid, diluted with two or three times its weight of water. Thus procured, Carbonic Acid Gas is colourless and transparent, having all the physical properties of common air, with a peculiar odour and a sharp taste. 100 cubic inches of it weigh 47·37 grains, its specific gravity is 1·527: it may be condensed into a liquid; and even to a solid†. It cannot support

* This gas was formerly known under the names *spiritus lethalis*, *spiritus sylvestris*, *fixed air*.

† In the apparatus in which it is condensed, if the stop-cock be opened to admit of the expansion of the unliquified gas, the cold produced by the expansion and rushing out of the gas, freezes it when any substance is opposed to it.

respiration nor combustion*. It renders lime-water turbid; but, in a saturated solution in water, it dissolves lime. Water absorbs it in an equal volume; but, under pressure, two or more volumes may be taken up. The water receives from it an agreeable, acidulous taste; and the solution reddens litmus. It combines with salifiable bases and forms carbonates. It is from the extrication of this gas in fermented liquors that they derive their briskness. It has also a curious property of passing by endosmose through animal membranes and displacing oxygen.

Carbonic acid is a compound of 1 eq. of Carbon = 6·12 + 2 of Oxygen = 16, equiv. 22·12, or 100 parts consist of 72·73 Oxygen and 27·27 of Carbon.

Carbonic acid, when dissolved in water and taken into the stomach, appears to act as a tonic upon the nerves of the viscus, checks nausea and vomiting, raising the spirits and increasing the appetite; but, when the solution is drunk too freely, it excites intoxication†: in the state of gas, it is an undoubted Sedative. A question, however, has been raised, whether this gas is positively or negatively Sedative? That it is positively Sedative is inferred from the fact, that, when the body is immersed in carbonic acid gas, if atmospherical air be freely admitted to the lungs, all the sedative symptoms produced by the gas—namely, weight in the head, vertigo, dimness of sight, singing in the ears, and an impression of alarm, occur: but, nevertheless, the sedative effect caused by breathing pure Carbonic Acid Gas is partly negative. As soon as it is attempted to be inspired, the glottis contracts, and none of the gas enters the lungs; but death ensues in the same manner as in drowning or in strangulation. This occurs even when the gas is mixed with nearly an equal bulk of atmospherical air; and the operation is more speedy than that of any other mode of suffocation. When mixed with more than twice its volume of air, it is taken into the lungs, and causes a sensation of constriction of the thorax, vertigo, loss of muscular power, insensibility, stertorous breathing, and a state closely resembling apoplexy. Thus, although in its undiluted state it cannot enter the cavity of the lungs, and it causes death by shutting out the agent which decarbonizes the blood, yet in its diluted state it acts as a sedative on the nervous system, destroying the animal in the same manner as sedative poisons‡. Carbonic Acid exerts also a sedative influence when applied to ulcers. Dr. Priestly, having excited pain in a blistered part by immersing it in oxygen, relieved the pain instantly by plunging the hand into a jar of Carbonic Acid Gas. If cancer has proceeded to a state of open ulceration, a stream of Carbonic Acid Gas, which

* Potassium, when heated in it, burns, and is formed into Carbonate of Potassa, whilst Carbon is extricated.

† Fodoré, Med. Legale

‡ Mem. sur les eaux min. de Naples, 8vo. Paris, 1804 In its concentrated state, carbonic acid gas destroys plants as well as animals.

has passed through water, and is directed on the part by means of a flexible tube, affords considerable relief to the pain*; and it is the extrication of this gas, in the fermentation of those vegetable matters that enter into fermenting poultices, which affords the relief obtained from them.

These sedative effects of the local application of Carbonic Acid Gas led to the employment of it as a remedy in Phthisis; but, although it appears to lessen the expectoration and to improve some of the symptoms, yet, as may be readily supposed, no cures have been effected by it. The carbonic acid, in this case, is respired, largely diluted with common air†. Its sedative influence in some diseases shall be afterwards noticed.

b. Cyanogen‡.

This substance forms the active constituent of several powerful sedative medicines. It is obtained, in the gaseous state, from Bicyanide of Mercury, by the aid of heat. The mercury is disengaged from the Cyanogen, and volatilized in a metallic state, whilst the Cyanogen is procured in the gaseous form, and may be collected in jars, over mercury. To procure it in this manner, the Bicyanide should be perfectly dry. Cyanogen gas is dense, colourless, and has a penetrating odour. It burns with a violet-coloured flame, but is incapable of supporting combustion. Water dissolves 4½ times, alcohol 23 times its bulk. It becomes a liquid under a pressure of four atmospheres, at 60°: 100 cubic inches weigh 55.5 grains. Its aqueous solution reddens Tincture of Litmus, and precipitates the salts of Iron blue.

It is a compound of 2 eq. of Carbon, = 12·24, + 1 Nitrogen, = 14·15 equiv. = 26·39. Two of its compounds—namely, *Hydrocyanic Acid* and *Cyanide* of *Potassium*—are employed as medicinal agents.

It exerts a deleterious influence on animal life, by operating as a direct Sedative.

CYANOGEN WITH HYDROGEN AND WITH POTASSIUM.

a. Hydrocyanic Acid§. *Acidum Hydrocyanicum dilutum.* L. *Acidum Hydrocyanicum.* E. *Acidum Prussicum.* D.—Although Cyanogen does not directly unite with Hydrogen,

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* Ingenhouz, Miscellanea, &c. 1795.

† Percival's Medical Essays, vol. i, p. 309. Warrington, 1789. *Johnson*, Experimental Researches, &c. 8vo. Philadel, 1797. *Mechry.* de Aeris fixi usu, &c. Gotting. 1796.

‡ From κυανος, blue, and γενναω, I engender.

§ This name was imposed by Gay-Lussac, from the fact that Cyanogen is acidified by hydrogen; hence he called the acid Hydrocyanic.

yet a compound of the two may be formed by double elective affinity; and thus an acid is obtained which possesses very peculiar properties on the living animal system.

This acid is formed in several processes, in which both animal and vegetable matters that do not naturally contain it are employed. Its constituents are prepared by the hand of Nature in the leaves of the Cherry Laurel, those of the Peach, in the blossom of the Peach, and in the seeds of the Apricot, the Bitter Almond, the Cluster Cherry, and several other plants. The volatile oil and the distilled water of these vegetable substances, as has been already stated, contain Hydrocyanic acid.

Hydrocyanic acid is artificially prepared for medicinal use; but in this state it is diluted with water, and so far it differs from the real acid. There are, therefore, two descriptions of hydrocyanic acid; the strong or *anhydrous*, the medicinal or *diluted.* Various processes have been proposed for procuring both of them. Vauquelin's process is the best for the strong acid; that of Scheele, modified, for the medicinal preparation. To procure the strong acid, the dry Bicyanide of Mercury, broken into small particles, is put into a tube about eighteen inches long, and less than half an inch in diameter. One end of this tube is connected with a flask, containing materials from which sulphuretted hydrogen gas is to be evolved and passed through the tube, which is placed horizontally, until the whole of the Bicyanide becomes black. The flask is to be then removed, and the upper end of the tube, which is to be gently inclined, closed with a little plaster of Paris, whilst the lower is to be attached to a small flask placed in ice. As soon as the plaster is set, the tube is to be gently heated, to drive forward the Hydrocyanic acid, which flows into the cool receiver. In this process, the Bicyanide of Mercury is decomposed by the Sulphuretted-hydrogen, the Hydrogen combines with the Cyanogen of the Bicyanide and forms Hydrocyanic acid, whilst the Sulphur combines with the freed Mercury and forms a Bisulphuret of Mercury.

Hydrocyanic acid, thus prepared, is a colourless, limpid fluid, with a penetrating odour, which causes severe headache, nausea, and fainting, when it is incautiously snuffed up the nostrils*, and leaves a peculiar sensation in the fauces. The taste is said to be acrid; but it cannot be tasted without danger.

This acid evaporates so rapidly, that a drop of it congeals by the cold caused by the evaporation of a portion of it; it boils at 80°; and its vapour is inflammable, burning with a blue flame. When mixed with oxygen gas, it detonates, leaving *carbonic acid, nitrogen gas,* and *water.* It combines with water and alcohol in all proportions, and faintly reddens litmus. Its sp. gr. is 0·7508.

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* This odour is generally compared to that of the peach-blossom; but it differs greatly from that odour.

This strong acid is so susceptible of decomposition, that it sometimes spoils within an hour after it is made; is converted, by spontaneous decomposition, into ammonia, and a black compound of carbon and nitrogen. It is so poisonous, that a drop of it placed on the tongue of a strong dog will cause instant death. It is not used in medicine. It is a compound of 1 eq. Cyanogen, = 26·39, + 1 Hydrogen, = 1:— equiv. = 27·3; or, 44·4 of Carbon, + 51·8 Nitrogen, + 3·7 Hydrogen, = 100.0.

The medicinal or diluted acid is procured in several ways. One very simple method, that of M. Proust, is to pass a stream of Sulphuretted-hydrogen gas through a solution of Bicyanide of Mercury until no more Sulphuret of Mercury is precipitated, or until the filtered fluid, when mixed with a solution of Sulphuretted-hydrogen, remains colourless and transparent. It is then to be decanted and agitated with Carbonate of lead, to remove any excess of Sulphuretted-hydrogen, and afterwards filtered. In this process the Bicyanide is decomposed in the same manner as in the former process. An acid of any given strength may be thus prepared.

The following are the processes of the British Pharmacpœias. The London College orders two ounces of Ferrocyanide of Potassium to be dissolved in half a pint of distilled water, then mixed with an ounce and a half of Sulphuric acid, previously diluted with four ounces of water and cooled; and this mixture to be distilled into a cooled receiver containing eight fluid ounces of distilled water, until six fluid ounces of the water passes over. Lastly, as much water is to be added as will bring the acid to such a strength that 12·7 grains of nitrate of silver dissolved in water will accurately saturate 100 grains of it. The Edinburgh College orders three ounces of the Ferrocyanide, two fluid ounces of Sulphuric acid, and sixteen fluid ounces of the water: the distillation to be conducted in a mattrass containing a little sand, until fourteen fluid ounces pass over; after which, distilled water, sufficient to make up sixteen fluid ounces, is to be added to the product. Both of these processes afford a good diluted Hydrocyanic acid; but, in using the London process, I think it preferable not to stop at the point ordered, but to carry on the distillation to dryness, and to dilute the product to the requisite strength. The residue is Prussian blue and Bisulphate of Potassa. The theory of these processes, according to Mr. Everett, is as follows. Six equivalents of diluted Sulphuric acid acting upon two equivalents of Ferrocyanide of Potassium, decompose three of the four equivalents of the Cyanide of Potassium, which the Ferrocyanide contains; and, at the same time, three equivalents of water, the oxygen of which uniting with the Potassium forms Potassa, which, combining with the Sulphuric acid, constitutes three equivalents of Bisulphate of Potassa: whilst the three equivalents of the Hydrogen unite with the Cyanogen freed from the Potassium, and constitute three equivalents of Hydrocyanic acid. The

residue is the Bisulphate of Potassa and an imperfect Prussian blue. The Dublin College orders one ounce of Bicyanide of Mercury, seven fluid drachms of Hydrochloric acid, eight fluid ounces of water, to be distilled until eight fluid ounces pass over into a cool receiver. An acid of sp. gr. 0.998 is thus procured; and a solution of corrosive sublimate remains in the retort. The chief recommendation of this process is its economy: but, if too much Hydrochloric acid be employed, the results will be a small proportion only of hydrocyanic acid, a chloride of ammonia and mercury, and formic acid.

The London College orders this acid, also, to be prepared by decomposing forty-eight grains and a half of Cyanide of Silver, mixed in a fluid ounce of distilled water, with thirty-nine grains and a half of Hydrochloric acid. The whole is to be shaken in a well-stopped phial, and, after the precipitate falls, the clear supernatant fluid to be decanted. The theory of this process requires no explanation.

The last process which I shall mention, is to mix together twenty-two grains of Cyanide of Potassium, fifty of crystallized Tartaric Acid, three fluid drachms of rectified Spirit, and six of distilled Water: and, after occasional agitation for ten minutes, to decant the supernatant fluid. In this process, the Cyanide is decomposed, as well as a portion of the water in which it is dissolved, the Oxygen of the latter unites with the Potassium and forms Potassa, which, combining with the Tartaric acid, forms Bitartrate of Potassa, which is precipitated by the Alcohol, and the Hydrogen attracted to the Cyanogen constitutes the Hydrocyanic Acid containing a definite quantity of water and alcohol*.

The weak acid formed by all of these processes is the same. It is a limpid, colourless liquid, with the peculiar odour of the strong acid, affecting the fauces, and having a taste at first cooling, but afterwards slightly warm. It should evaporate without leaving any residue, and should redden litmus very slightly and fugaciously: when the red is deep and permanent, some foreign acid is present. The solution of Chloride of Barium will detect the Sulphuric, Nitrate of Silver the Hydrochloric acid, when the precipitate is insoluble in boiling Nitric acid. This diluted acid is a compound of 2 parts of anhydrous Hydrocyanic acid, + 98 of Water, = 100.

The physiological influence of Hydrocyanic acid is modified by its degree of concentration or dilution. It operates as a powerful Sedative on all organic beings, vegetable or animal: destroying their irritability and proving rapidly fatal. Among animals, the cold-blooded are more slowly affected than the hot-blooded. In its anhydrous state, Hydrocyanic acid is so powerful a poison, that a single drop of it introduced into the

* This mode of preparation was proposed by Dr. Clarke. The above formula is that of Mr. Laming.

stomach of a dog, or injected into the jugular vein, or even applied to the eye, will destroy the animal almost as instantaneously as the most powerful shock of an electrical battery. When death is thus rapid, convulsions rarely occur; but when the dose or the strength of the acid is not sufficient to kill instantaneously, convulsions, preceded by vertigo, faintness, and insensibility, display themselves*. This rapidity of action is incompatible with the idea that it is taken into the circulation before it exerts its sedative influence. It seems to act directly on the nervous sensibility, which it completely extinguishes; and in smaller animals this is effected by the vapour of the acid, even when it is largely diluted with atmospherical air. Many arguments, however, have heen brought forward to prove that it is absorbed; but the question is still subjudice†. The usual symptoms, in cases of poisoning by the weak or medicinal acid, are confusion or stupor and numbness, with a sense of weight or pain at the top of the head; yawning, irresistible drowsiness, vertigo, and dimness of sight; the pulse, which is at first not affected, quickly flags, and becomes slow and vibrating; but, before this takes place, vomiting and hiccup sometimes occur, the extremities are paralyzed, the pupils remain dilated, and every function seems destroyed, except respiration, which is rarely either accelerated or difficult. These poisonous effects have too often been witnessed. In a case mentioned by Hufeland, a strong and healthy man, who was seized as a thief by the police, whilst in the act of being conveyed to prison, took a small phial from his pocket, broke off the neck of it, and swallowed the contents. He staggered a few paces, then fell on his knees, and instantly expired without a struggle‡. It affects all animals indiscriminately, from the worm up to man: all are killed by large doses of it, and all die nearly in the same manner. An instantaneous cessation of vitality takes place; yet, in animals, the eyes are open, and they glisten and appear animated, as if alive§. Although the sensibility is thus so completely destroyed that nothing can again arouse it into activity, yet, if the body be opened immediately after death, the action of the heart is seen proceeding, and the most beautiful demonstration is afforded of the movements, vermicular and peristaltic, of the intestinal canal.

The post-mortem examination of the body exhibits the blood

* For an interesting case illustrative of this fact, detailed by Dr. Geoghegan, when the dose was increased daily until two drachms were taken for a dose, see *Dublin Medical Journal*, Nov. 1835. Recovery rapidly followed the inhalation of the ammonia from the solid sesquicarbonate applied to the nostrils.

† Muller's Elem. of Physiol. Trans. vol. i, p. 627.

‡ Journ. de Med. et de Chirurg. Jan. 1815. Both Scheele and Scharinger are supposed to have fallen victims to its power.

§ When the strong acid, however, is employed, the extreme coldness caused by the evaporation, renders the cornea, when it is applied to it, opaque.

congested in the right ventricle of the heart and the veins; it is more than usually fluid, and sometimes exhales an odour of the acid. The venous turgescence extends to the brain and spinal marrow. These appearances afford no means of determining upon what part of the system Hydrocyanic Acid especially operates. The convulsions can be referred to the abstraction of stimulus from the nervous centres; for the same symptoms occur in large and sudden hemorrhages, after the artificial abstraction of more blood than the system can spare.

With respect to the period of time in which this acid produces its fatal effects, I have seen it destroy a dog, before he could be put upon the ground, from the knee of the person who held him during the administration of the poison. In some experiments made by Mr. Macaulay, of Leicester, one dog, to which four drachms of the diluted acid were given, died in eight seconds; another, who swallowed four drachms, in seven seconds; and another, who took four drachms and a half, in three seconds. In these cases there is scarcely room to doubt that absorption could not have taken place. It would, however, be uncandid not to mention the experiments of Dr. Krimer, of Aix-la-Chapelle, which are intended to prove that, notwithstanding the rapidity with which Hydrocyanic Acid destroys life, it may, nevertheless, be taken into the circulation. He found that it does not act when it is applied directly to the medullary matter of the nerves; nor when it is applied externally to the brain and spinal marrow. He asserts that, when applied to the tongue, it does not kill until it is evaporated by the heat of the organ, and is absorbed into the pulmonary circulation, when it kills by first diminishing the action of the heart and then that of the spinal marrow. He says that when the arteries and veins of a part are tied, and the nerves left entire, and the acid is introduced into a wound, it does not act, but it takes effect the moment the ligatures are removed from the blood-vessels; and that death also occurs when the nerves are divided, if no ligatures be used. When the gastric vessels are tied, although the nerves remain entire, Hydrocyanic Acid, when swallowed, does not produce its usual effects: but it operates immediately when it is placed on the tongue; and in thirty-six minutes it can be detected in the blood by reagents: which is also the case when it is inhaled without the vapours coming in contact with the nerves of the tongue. These experiments of Dr. Krimer are, prima facie, apparently confirmed by those of Sir B. Brodie with volatile oil of bitter almonds. A single drop applied to the tongue of a cat caused violent convulsions, and the animal then lay on one side, motionless, insensible, and breathing in a hurried manner, until she died, which occurred in five minutes. On opening the thorax, the heart was found pulsating eighty beats in a minute, and circulating dark blood. The same effects resulted from in-

jecting two drops of the oil, in half an ounce of water, into the rectum of the animal; so that the first experiment affords no support to Dr. Krimer's theory. Notwithstanding, therefore, the apparent conclusiveness of Dr. Krimer's experiments, the justness of his conclusions may be doubted. I cannot conceive how the acid can be taken into the lungs without acting on the nerves. On these accounts, and from witnessing the instantaneous effects of this poison, I see no reason for altering my opinion respecting the manner in which it acts on the animal œconomy, when taken in doses sufficient to cause instantaneous death.

b. CYANIDE OF POTASSIUM. *Potassii Cyanidum.*—This substance does not hold a place in any of the British Pharmacopœias. It possesses the same sedative properties as free hydrocyanic acid. As it is always of the same strength and is not liable to spontaneous decomposition, it might be advantageously employed instead of hydrocyanic acid as a remedial agent—an idea suggested by MM. Villermé and Robiquet*. It is prepared by exposing the Ferro-cyanide of Potassium to a red heat, for some time, or until decomposition takes place: lixiviating the residue, filtering and evaporating the solution. The Cyanide of Potassium is thus obtained in cubic crystals. It is a binary compound of Cyanogen and Potassium; and may be thus described (2 C. + N.) + P., equiv. = 64.54. One grain placed on the tongue of a large Guinea pig, killed it in three minutes†. When one part of the Cyanide is dissolved in eight parts of water, a solution is formed, which may be administered in the same doses as the hydrocyanic acid.

Dr. Buttigny and Dr. Lombard, of Geneva, have successfully employed this preparation, both in the state of solution and in the form of ointment, externally, in neuralgic affections: the solution containing from one to four grains of the Cyanide in each fluid ounce of water; and the ointment from two to four grains in every ounce of lard. Both are beneficial; but Dr. Lombard says the solution acts more promptly than the ointment. This Cyanide has been found to relieve also the pains in chronic rheumatism. It is, however, according to Dr. Lombard, contra-indicated when the nervous affection is complicated with a state of inflammation.

In whatever form the compounds of Cyanogen may be administered, much caution is requisite in regulating the dose according to the strength of the patient, and watching the effects of the remedy: it is, therefore, important to know in what manner the symptoms of an overdose are to be counteracted. There is no time for freeing the stomach of its contents; hence we

* Bull. de la Soc. d'Émulation, Juillet, 1823, p. 411.

† Journ. Physiol. &c. par M. Majendie, tome iii, p. 280.

must immediately consider what will decompose the acid remaining in the stomach, and, at the same time, overcome the general effect of the poison on the nervous system. With this object in view, the use of Ammoniated Iron was suggested by myself, and that of the Sulphate of Iron recommended by M. Virey; but both are said to be inferior to Chlorine, which was first proposed by M. Simeon, whose opinions have been fully confirmed by a series of experiments upon dogs by MM. Peresy and Novat; and some conducted in my own laboratory. The Chlorine so completely neutralizes the action of the hydrocyanic acid, that, in one instance, when respiration had been suspended for twenty-five seconds, the animal who was apparently dead, was rapidly revived by the Chlorine, and in a short time recovered its usual vivacity*.

If Chlorine cannot be instantly procured, cold water should be dashed upon the face and back, as recommended by M. Herbst; and Brandy, Ammonia, and other excitants, freely administered.

B. PONDERABLE AGENTS.

a. BLOOD-LETTING.

The blood is a primary fluid, and its quantity is greater than that of any other fluid in the body: it is the pabulum of the solids, the source of every secretion, and, with the exception of the epidermis, the enamel of the teeth, the body of the crystalline lens, and few other parts, it is generally diffused over all parts of the system. It first passes through a series of gradually diminishing tubes, the *arteries*, propelled by the action of the heart; and it is again returned to that viscus through another series of gradually enlarging tubes, the *veins*. In man, its average proportion to the weight of the body, in a healthy adult subject, is as *one* to *five*: when the relative proportion is greater than this, an unnatural or diseased state of the habit, *plethora*, exists: when the relative proportion is smaller, the body becomes emaciated: when it is suddenly abstracted, a series of phenomena occur which display a diminished degree of vitality; and, if the quantity taken away exceed a certain proportion of the whole, death immediately ensues. The abstraction of a certain proportion, therefore, produces a sedative effect on the habit. According to the manner in which the blood is abstracted, blood-letting is regarded as general or local.

General Blood-letting is effected either by venæsection—that is, a mechanical division of the coats of a *vein*, in which the

* It is, nevertheless, stated by Coullon and M. Colles that the action of the Cyanide of Chlorine on living animals is the same as that of Hydrocyanic Acid. Dic. Mat. Med. Univ.

current of the blood towards the heart has been previously obstructed by a ligature—or by arteriotomy, the mechanical division of the coats of an artery. The influence of either of these operations on the general œconomy is determined by the quantity of blood abstracted; but the effect varies in different individuals, according to the strength and the constitution of the patient; and, in the same person, according to the period of life, the state of health, and the *manner* in which the abstraction is accomplished.

Before passing to the consideration of blood-letting as a sedative, it is almost superfluous to state that blood is the agent which excites the heart to action and maintains the temperature of the body.

The action of the heart commences in the second or third week after conception, and continues to the last moment of existence; and its structure is admirably adapted for this perpetual and equable motion. The contraction (systole) and relaxation (diastole) of the heart, are states of action and repose: the former propels the blood into the arteries, the latter permits it to be poured from the contiguous veins into the cavities of the heart. These actions can be distinguished by distinct sounds, on placing the ear on the chest of a healthy person, between the cartilages of the fourth and seventh ribs, or under the lower part of the sternum, either with or without a stethoscope. The action of the ventricles is a dull sound; that of the auricles a clearer sound, similar to the noise of a valve, or somewhat like the licking of a dog. This action of the heart, by causing a pressure of the column of blood against the elastic walls of the arteries, at every contraction of the ventricle, communicates an impulse to the arteries, which is manifested to the finger, in all their branches that do not exceed one sixth of an inch in diameter. This constitutes the pulse, every beat of which indicates the *systole* or contraction of the heart: and every pulsation is synchronous with the contraction of the left ventricle. Or, in other words, the pulse is the effect of the oscillations propagated along the coats of the arteries, and in the blood itself, from the impulse communicated to the blood by the heart*. The diversity of the pulse at various periods of life, in different sexes, and as modified by climate, has been well ascertained. It is altered by watchfulness, sleep, exercise, the depressing and exciting passions, meals, the discharge of the seminal fluid, and disease; and it is this index of velocity, force, tension, and general state of the mobility of the heart, which, in most instances, enables us to decide as to the propriety of abstracting blood.

The circulation of the blood in man is completed in from one to two minutes; but the celerity of the blood in health varies,

* Weber, Adnotat. Anat. et Phys. prob. 1.

not only in different persons, but in the same individual in different parts of the body; the velocity being greatest in the arterial trunks, in the ratio of diminished friction, and less in the branches. During health, in an adult, there are from 68 to 75 pulsations in a minute, depending on contractions of the heart closely connected with its irritability; and that this pulsation is attributable to the nerves is very evident, from the influence of the passions over it, and its sympathy with the stomach, displayed in various diseases. It thus appears that the blood passes through every part of the system ; and, in doing so, it undergoes some important changes; as it differs in its characters in the veins and in the arteries. But these circumstances only refer to the blood, in a healthy state of the body, circulating in due quantity.

During life, the blood vessels are always in a certain degree of tension, by which the tone of the system is maintained: blood-letting diminishes this tension, and is followed by relaxation and debility; consequently this operation produces a sedative effect on the frame. On opening a vein in the arm, the first effect is diminished tension, not only of the blood vessels, but of the whole system; the secretions become less copious, from part of the supply of blood being cut off; and perspiration flows more freely. As the abstraction of blood continues, the patient begins to feel slight dizziness; singing in the ears; a loss of consciousness; and, in proportion to this, the breathing is more or less affected, being generally suspended until the painful sensation produced causes deep and repeated sighs, after which it is again suspended; the pulse becomes slow and weak, the face pale and bedewed with perspiration: and sickness follows. These symptoms evidently indicate that the brain is the organ the function of which is first impaired, and this appears to be the result of the defect of stimulus: the respiration suffers as an immediate consequence; and the enfeebled action of the heart is not only the effect of a deficient quantity of blood, but of its incomplete arterialization in passing through the lungs. On recovering from such a state, there is yawning, a return of consciousness, irregular sighing, deep-drawn breathing, the gradual development of the pulse, and not unfrequently transitory delirium.

The *mode* of performing blood-letting very much regulates the effect: little change occurs when even a large quantity of blood is abstracted slowly and gradually through a small orifice, especially if the patient be in the horizontal position: but syncope follows its abstraction through a large incision; and suddenly, also, if the patient be seated, or in the upright position. This depends on the tension of the whole system, which, on the rapid abstraction of the blood, is more quickly removed than will allow the vessels to adapt themselves to their

contents: it seldom occurs in local or topical bleeding, the abstraction of the blood being slow and confined to the part on which it is performed. In ordinary venæsection, also, the abstraction being less rapid than in arteriotomy, and the momentum of the blood greater in the arteries than in the veins, the production of syncope is not so constant as in opening an artery. These effects of the different modes of blood-letting are important to be recollected, in a practical point of view, in the employment of blood-letting as a Sedative. Arteriotomy is now rarely performed, except in cases of Apoplexy or Phrenitis, when a sudden and very powerful effect is requisite; as syncope can always be obtained by venæsection, if the orifice be sufficiently large and the patient be placed upright. If blood-letting be carried beyond a certain point, instead of the symptoms which I have been describing as indicating recovery from syncope, the countenance becomes pale and sunk, the breathing stertorous, and terrible gasping follows; the pulse sinks until it is imperceptible; the animal heat fails, and cannot be restored to the extremities by any external warmth; there is constant restlessness and jactitation; every thing indicates an exhausted condition of the energies of the brain; and the patient sinks, gasps, and expires. When the abstraction of blood is within more moderate bounds, the effect produced is the result, in some degree, of the mere mechanical influence of diminished tension; for the momentum of a moving body being in the direct ratio of its weight, this is diminished; and the moving power remaining the same, the velocity of the body being in the indirect ratio of its bulk, the velocity is increased: hence the mechanical result of a general abstraction of blood is to diminish the force, but to augment the velocity of the pulse. As the pulse is thus rendered feebler, so it is softer; and this diminished tension being extended, the whole system becomes languid, and the action of the heart weaker. Some effect is also produced on the blood itself. Considered as a mechanical mixture, the serum is increased in quantity and the crassamentum diminished: the coagulability is augmented, but the coagulum is less firm. Whether in its chemical constitution any change is effected by the production of syncope has not yet been clearly ascertained.

Many other circumstances, besides the mode of abstracting blood, demand attention, as modifying the result of the operation:—these are age, temperament, sex, mode of life, climate, and the quantity abstracted.

1. With regard to *age*—in infancy the laxity of the solids, and the relative proportion of the serum or watery part of the blood to the crassamentum or clot, which consists of fibrin and colouring matter, are more considerable than in adult age: blood-letting, by increasing this greater proportion of serum, proves

hurtful; and a state of syncope in infants is always one of great danger. The first effects of exhaustion in young subjects is an increased degree of irritability, which leads to stupor, and generally terminates in convulsions: the pulse is quickened, the pupil of the eye dilates, and symptoms present themselves closely resembling those which precede the effusion of water in the ventricles. I have seen this occur, more than once, in children in whom symptoms resembling those of inflammation of the brain, accompanying irritation of teething, have displayed themselves; and leeches or cupping has been resorted to; but, instead of affording relief, a state of evident defective stimulus has supervened; and, in one case, snoring, stertor, and other appearances of apoplexy, having followed the bleeding, more leeches were applied, and the infant died. This condition is readily detected by attention to the state of the breathing, which seems to be performed almost wholly by the diaphragm; and is always accompanied with the evolution of much flatus. It is best obviated by white wine whey, opium, and ammonia, administered warm, in small quantities, and frequently repeated. In youth, and in the vigorous and robust in adult age, on the contrary, reaction takes place, and is especially marked after repeated venæsections. In old people the reaction is extremely feeble; and, during the flow of the blood, exhaustion often steals on so insidiously and imperceptibly, that, when nothing injurious is anticipated, syncope appears; no reaction can be induced, or it is defective, and gives way to a state of positive sinking. The risk in such a case is extreme. The most favourable age for bearing blood-letting is from eighteen to forty-five.

2. With respect to *temperament*—those possessed of a sanguine temperament bear blood-letting worst. In these, therefore, it must be used with more caution than in the phlegmatic or the melancholic. But the capacity of supporting the loss of blood is not always to be ascertained by its effects in producing syncope; nor is this always to be regarded as the translation of reaction into exhaustion; the syncope often proceeding from a peculiar idiosyncracy. One person of a strong and vigorous habit will faint on losing the smallest quantity of blood; another of a weak and puny habit will bear large abstractions of it without feeling even the approach of syncope.

3. Men, owing to the nature of their organization, and their higher degree of tone, bear, in general, blood-letting better than women. Some circumstances connected with sex, also—for instance, the presence of menstruation—have usually rendered practitioners cautious of abstracting blood: but, if the patient be labouring under acute inflammation, or any disease which requires blood-letting, it is not to be omitted on this account.

4. The *mode* of life, also, modifies the effects of blood-letting.

The inhabitants of the country, engaged in agricultural occupations, and much in the open air, bear the loss of blood better than those of the town; those of active better than those of sedentary habits: the sportsman than the studious man, the labourer than the man of science. It has been often supposed that the luxurious and self-indulgent are more able to bear bleeding than the moderate and the temperate: but this is not the case; for, although luxurious indulgence favours plethora, yet it is accompanied with a laxness and debility of habit, which are soon exhausted by the abstraction of blood.

5. With respect to *climate*, venæsection is better borne in temperate than in either hot or cold climates. In warm climates, although inflammatory states of the habit, with topical inflammation, frequently occur, yet these are always accompanied with increased irritation, and sooner followed by a state of collapse than inflammatory affections occurring in temperate climates; consequently the lancet is to be used with caution. Under the influence of pure inflammation, the sedative effects of general blood-letting is less felt than even in health; this state has been well remarked by Dr. Marshall Hall, being "a sort of concentrated and permanent stimulus, exciting and maintaining the powers of the system," and "whilst it exists, constituting a stimulus and a protective power against the influence and effects of loss of blood*." Now, as this state more frequently occurs in temperate than in warm climates, the loss of blood is better borne in the former. In cold climates, the rapid reduction of the animal temperature, produced by blood-letting, is one reason for employing it with caution: indeed, this is not confined to blood-letting, but the rule extends to the employment of all Sedatives.

6. The most important circumstances to be attended to, as modifying the effects of the abstraction of the blood, is the *quantity* which can be lost by the patient. From what has been already said, it must be obvious that the degree of sedative effect produced must be in the direct ratio of the quantity abstracted. Fashion has too much regulated this; and, at one time, we find practitioners bleeding with a small orifice, and in moderate quantity, on all occasions; at another, abstracting the most hazardous quantities of the vital fluid, with the largest orifice: consequently, in the most sudden manner, and with a degree of indiscriminate rashness, which to the eye of judgment is truly frightful. Both extremes are improper. The due quantity must be regulated by the constitution of the patient and the nature of the disease. It has been ably argued, in the work to which I have already alluded, "that the power and susceptibility of the system, in regard to the effects of the loss

* Hall on the Morbid and Curative Effects of Blood-letting, p. 203.

of blood, may generally be determined by placing the patient in the erect posture, perhaps with the eyes turned towards the ceiling, and taking the blood from a moderate-sized orifice, until the first or slightest appearance of syncope be induced; the quantity of blood which thus flows denotes that power or that susceptibility respectively." It is also argued that this first appearance of syncope manifests the quantity to be taken, the power of the system for supporting the loss of blood being exactly in proportion to the necessity for blood-letting. But, from what has been previously said, although this rule may hold good in many instances, yet there are exceptions to it; and mischief might result if too close an adherence to such a general rule were observed. I have witnessed cases of decided inflammation, in which syncope occurred after three or four ounces of blood were taken; yet, on repeating the operation, a few hours afterwards, from twenty to thirty ounces were abstracted without the least evident approach of syncope. On the other hand, we are not always to wait for the approach of syncope; for, although the inflammatory state of a disease renders the system, otherwise incapable of bearing the loss of much blood, able to sustain it, yet this protecting influence is not always marked by the non-appearance of syncope. In the lectures of Mr. Lawrence, is the case of a young female of slender habit, in whom depletion was tried to its full extent, and eight-and-forty ounces of blood taken away without fainting being produced. "The blood," says Mr. Lawrence, "still ran out in a vigorous stream into the vessel, without touching the surface of the arm, to the very last. In the end I stopped it, because the quantity did seem to me to be so very great. Now," continues he, "that single venæsection cured her; she was well from that time; all the symptoms were removed; she had no further symptom indicating inflammation of the chest*." Upon this case we may remark, that we are to discriminate as to the quantity of blood taken, without, in every instance, waiting for indications of syncope; as this is not invariably necessary in order to secure the beneficial sedative influence of blood-letting. It is not improbable that, if the blood had been permitted to flow in this case until the tendency to syncope displayed itself, the transition from reaction to sinking would have been sudden; and, although the patient had rallied for a little time, yet the effect might have been fatal. It is the last drop of blood abstracted which either relieves the disease or hurries on the fatal issue: the reaction may be moderate and salutary, or a state of sinking and sudden death may follow if we proceed till a tendency to syncope occur, if the bleeding be carried to a considerable extent before this state presents itself. If, during the flowing of the blood, the

* Lancet, No. 325.

pulse become fuller and stronger, the power of bearing the depletion, and the necessity for it, are both indicated; if the pulse become small and feeble, the bleeding must be stopped.

It is not easy to reconcile the accounts of the large abstractions of blood often taken by the older physicians with the moderate bleedings that habits of the present race of men will bear. In acute Rheumatism, Sydenham, who practised in London, used to order forty ounces of blood to be abstracted—a degree of depletion which could not now be ventured upon in this disease. The inactive habits of more civilized men, the higher cultivation of intellect, the less necessity there exists for the aid of mere brute force in the works of the artisan, and the general use of spirituous liquors, instead of beer, may, in some degree, account for this change of constitution. Another practice has also been discontinued by well-informed physicians, which was formerly prevalent; that is, the repetition of venæsection as long as the appearance of a buffy coat in the blood presents itself. This custom arose from the erroneous idea of the nature of this coat: we now know that it depends on the slow coagulation of the blood, which occurs from the change produced by the inflammatory action on the vital fluid; the red globules sink to the bottom before the fibrin has become sufficiently solid to entangle them in it, and thus the latter coheres more firmly and assumes its natural pale colour. But the nature of the change which gives rise to this is unknown. The buffy coat will appear in the last bleeding, which may occasion a fatal syncope; it often arises from the mode of bleeding, and consequently is not to be relied upon. Such are the general views which ought to guide us in the use of this powerful Sedative, when it is employed with a view of producing a decided effect on the habit.

Local Blood-letting is useful as an auxiliary to general blood-letting; it is better fitted to relieve in some cases of irritation in which general blood-letting would prove hurtful, and in cases of local inflammatory action. In chronic inflammation affecting the cavities of the body, local is more appropriate than general blood-letting; and this is true also respecting other partial affections.

Blood may be locally abstracted either by *cupping* or by *leeches*.

Cupping is of very ancient date, and is still performed by some of the rudest nations. A horn was perhaps the first cupping instrument, and suction by the mouth of the operator the mode of exhaustion. This was indeed one of the two kinds described by Celsus*. The other was performed by a copper

* Cornea per se corpori imponitur; deinde, ubi ea parte, qua exiguum foramen est, ore spiritus adductus est, superque cera cavum id clausum est, aeque inhæresceit. —De Re Medicina, lib. ii, § xv.

cup, in which linen was burnt to produce the vacuum, in the same manner as the French still use tow in their cupping glasses. The principle of the cupping glass is to produce a determination of blood to the scarified part, by removing from it the pressure of the atmosphere: much, therefore, depends on the exhaustion of the cup; if it be not sufficient, the determination is inadequate to produce a free flow of blood into the cup: if it be too great, the edges of the cup operate as a ligature on the surrounding vessels, and check the flow towards those that have been divided.

When the quantity of blood to be taken from any part is considerable, and especially if it be requisite to abstract it quickly, so as to produce an immediate effect, then cupping is preferable to the application of leeches. From the manner in which the blood is taken by cupping, syncope rarely occurs, unless from fear; consequently this method of abstracting blood is ill calculated to produce a sedative effect upon the habit; although, in cases where the lancet has been previously employed, a degree of sinking occasionally occurs which is alarming. This, however, is less likely to happen than when leeches are employed; as, from the nature of the incisions made by the scarificator, the bleeding is more under control than it is from the orifices produced by the bites of leeches.

We have no exact account of the time when leeches were first employed. Themison used them, and we find directions for using them in a work of Hieronymus of Nigrisol*. They may be applied to any part of the skin, if it be clean, and freed from hairs. The corium, or true skin, which displays the rings of which the body of the leech is composed, seem to be semi-cartilaginous, and capable of expansion to nearly three times their natural magnitude; hence the quantity of blood which the leech can draw is greatly disproportionate to its natural size. Mr. Kennedy has stated, on the authority of experiment, that it is equivalent to the weight of the animal: M. Moquin Tandon affirms that a small lively leech will take twice its weight, a middle-sized one one-half its weight, and a large one its weight: Derheim says six times its weight. As far as I have been able to observe, the average is about two drachms. This, however, is no criterion of what is obtained; for the blood continues to flow after the leech falls off; and, by applying a poultice or warm water to the orifices, or a cupping glass over the place, a considerable quantity may be afterwards abstracted. It is a curious and still unexplained fact, that the blood taken into the body of a leech remains for two or three months uncoagulated and free from putridity: the only change it suffers is that of becoming deeper in colour, and a little thicker in consistency.

* Progymnasmata seu de Hirudinum appositione internæ parti uteri.

When the animal is gorged with blood, it drops off; and this usually occurs in ten or fifteen minutes: but occasionally it will remain fixed to the spot for a considerable time, as if from indolence; but it is easily roused from this state by sprinkling it with a few drops of cold water. The ancients, when they wished to abstract a large quantity of blood with few leeches, we are told, snipped off their tails when they were in the act of sucking: and that the blood flowed drop by drop from the artificial opening, whilst the leech continued to suck. The same effect is produced by an incision made by a lancet near the tail of the animal when it is sucking*.

There are some circumstances connected with the application of leeches that require to be noticed. An erysipelatous inflammation sometimes follows their application, which has been referred to a peculiar irritable state of the skin of the patient; but which has been ascertained by M. Derheim to proceed from taking off the leech by force when it is sucking; thus causing the teeth to separate from the animal and remain in the wound.

The leech should, therefore, always be permitted to drop off spontaneously: and when it drops off, it should be thrown into water slightly salted, till it disgorges the blood; after which, it should be thrown into clean water.

Various means have been suggested to facilitate the application of leeches; the part should be made clean and dry, and the leech also dried in a clean cloth before applying it. We are then directed to place the leeches in a glass or in the lid of a pill

* It is curious that the circumstance of the leech dropping off when it is gorged, has never suggested the question—what causes the leech to drop off when it is gorged?—The usual reply which I have received to this question is that the leech has had sufficient; or that it drops off from the uneasiness of distension. This, however, is not the case: it drops because it falls into a state of asphyxia, from want of respiration; and I found this opinion upon the following grounds. The respiratory organs of the leech are a number of vesicles in immediate contact with the lateral longitudinal vessels, small twigs of which communicate with these vesicles, to submit the blood to the action of the air, which is admitted by stigmata or spiracules, which are arranged on each side of the under surface of the animal, between every fifth ring. As the vesicles contain a whitish fluid, they are supposed, by De Blainville, Johnson, and Brandt, not to be respiratory organs: I have, however, satisfied myself that they are breathing organs; for, by closing these pores with viscid oil, the leech dies in a few days. Now, these vesicles communicate with the air; and, although the leech can live for some days under oil and in the exhausted receiver of an air-pump, yet, from an experiment made by Dr. Edwards, it is evident that the leech respires and consumes the oxygenous portion of the air; and we may infer that the animal, by filling these vesicles with air, can exist for some days without a fresh supply: but it by no means follows that they can exist if these vesicles be entirely emptied. My opinion, therefore, is, that the animal continues capable of exerting the function of sucking as long as these vesicles contain a sufficiency of air for the respiration to be carried on; but, as the body becomes greatly distended with blood, the cavities of these vesicles are obliterated; no respiration can consequently take place; and, like animals that breathe by lungs, asphyxia occurs as soon as air ceases to be retained in these vesicles, and the muscular energy depending on volition being no longer exerted, the leech drops off. If it be true that when the tail is punctured or is cut off the leech continues to suck, it is because no asphyxia occurs; for the vesicles are not compressed, and therefore the leech continues to suck.

box, and invert it upon the affected part; or, if this fail, to scratch the surface of the skin with the point of a lancet, and to apply the leech on the spot moistened with blood. The best and simplest method is to fold up a clean soft towel like a napkin, to make a small hollow in it with the points of the finger, into which the dried leeches are to be placed. On applying the towel, it is to be held over the part by placing the hand on it until all the leeches bite, after which it is to be removed. If the skin be much inflamed and hot, a little tepid water should be poured into the water containing the leeches, before they are taken out of it to be applied; and this should also be done, if it be requisite to apply them within the mouth, on the verge of the anus, or within the vagina. If the patient be taking sulphur internally, or externally applying it, leeches will not bite; neither will they bite, if tobacco-smoke, or vinegar in vapour, or sulphur, or any fœtid odour, be diffused through the apartment of the patient.

When leeches are applied to soft parts,—for instance, to the abdomen,—a large quantity of blood is sometimes obtained; particularly when a poultice is laid over the bites, and the patient is kept warm in bed: to prevent, therefore, injurious symptoms of exhaustion from such a circumstance, the poultice should be frequently examined. Danger from this cause is more likely to occur in children than in adults; and in children it not unfrequently happens that the bleeding cannot be stopped without much trouble. The best method of stopping the bleeding, when ordinary means fail, is to crush to powder a small piece of nitrate of silver, and to melt the salt in a watch-glass over a candle; and then to dip into the melted salt, the triangular pointed end of a silver probe, previously heated. The point becomes thus coated with the Nitrate; and by introducing it into the leech bites, they instantly cease to bleed*. The bleeding may be stopped by encircling the orifice with a ligature. On this account, leeches should never be applied late at night on children; for, as the application of leeches in infancy must be regarded as a species of general Blood-letting, the precise number which will regulate not only the quantity, but be equivalent to rapidity in the detraction of the blood, should be determined; and the bites should be instantly closed on observing that the system is brought under the influence of loss of blood. Instances have occurred in which death has followed the application of leeches to children; and sometimes even to adults.

By whatever means blood is abstracted, if the quantity be more than the constitution can bear to lose, morbid effects result. Thus, the *delirium* which frequently occurs has in some instances continued, and has worn out the patient. The first or second

* Proposed by Dr. James Hunter, Edin.—see Edin. Monthly Journ. of Med. Science, April 1841, p. 262.

bleeding may be well borne; but a repetition of it may produce sudden dissolution; the pulse falls, becomes a mere flutter, and the person rarely survives more than a few hours. And this may happen whether leeches or the lancet be employed. Effusion into the ventricles is not an unfrequent consequence of an extreme degree of vascular exhaustion. Sometimes, when reaction occurs, it is feeble, and continues so, causing fainting on the slightest exertion, and sometimes terminating in sinking to a hazardous degree. In other cases, the reaction produces symptoms resembling those of inflammation of the meninges of the brain; a hard beating pulse, particularly in the carotids; throbbing in the head; palpitation of the heart, and pulsation of the aorta; and these symptoms in children lead us to suspect hydrocephalus, when nothing but exhaustion demands attention. Instead of Blood-letting, light cordials, a mild but nutritious diet, rest and quietude, should be enjoined.

Practical Employment of Sedatives.

All the Sedatives which we have examined, with the exception of blood-letting, are powerful poisons: nevertheless, when they are properly administered, and their effects carefully watched, they are possessed of powers that cannot be obtained from any other medicines. They are chiefly indicated in diseases of increased sensibility and irritability.

Hydrocyanic Acid, the most powerful of the group of distinct sedatives, in the strength in which it is medicinally employed, is indicated in diseases connected with a state of excessive or morbid sensibility, and irregular action depending on a highly irritable state of the nervous system. Thus, in acute pleurisy, the pain is the greatest cause of suffering which the patient experiences; it is sharp, lancinating, increased by coughing, by inspiration, and every thing which produces movement in the thorax, or the slightest pressure on the affected side. The respiration is marked by a peculiar nervous agitation, caused by a full inspiration producing so much pain that a short, hurried, frequently repeated inspiration is carried on to compensate, by the admission of numerous small volumes of air, for the defect of a full inspiration. Hydrocyanic acid is well suited to quiet the irritation of the cough, and thus to procure the repose of the affected organ; but, beyond this, it has no pretensions to be regarded as a remedy in this disease. In *tubercular Phthisis*, the employment of laurel water, which owes its sedative properties to Hydrocyanic Acid is not of recent date; and although I have had no proofs of its utility in that intractable disease, yet, in small doses frequently repeated, it diminishes the hardness and the frequency of the pulse, and lessens the general hectic tendency. It has one advantage over narcotics, namely, that besides

moderating the cough, it frequently favours sleep, without augmenting those sweats which wear down the strength, and which are too often kept up by the administration of Opium. It should, however, be recollected that, owing to the depressing influence of this acid, it is in the early stages only of Phthisis that it can prove beneficial, even as a palliative. In another affection, as frequently fatal, *chronic Laryngitis*, I can bear testimony to its sedative influence in diminishing the cough and affording much comfort to the patient. I have generally prescribed it in combination with Ipecacuanha, in doses of three or four minims in the Bitter Almond emulsion, which also contains Hydrocyanic acid. It would be unfair not to notice here the experiments of M. Jorg, at Leipsig, on the Cherry Laurel water. He administered Cherry Laurel water to adults, in doses progressively increased, from five to twenty-five, and, finally, to one hundred and twenty minims. He states that the symptoms it produced were those of concentrated action of the brain, a sensation of weight in the head, drowsiness and torpor of the intellectual faculties, lassitude, retardation of the pulse, pain of the head, chiefly in the region of the optic nerve. It was, also, attended with symptoms not unlike those of Bronchitis. M. Jorg refers these symptoms to plethora of the cerebral vessels: but they may be as justly referred to paralysis of the brain.

In active hæmorrhages, not depending upon organic disease,—as, for instance, hæmoptysis,—besides general bleeding proportionate to the vascular organs and the strength of the individual, one of the best auxiliaries is Hydrocyanic Acid, in rapidly augmented doses, commencing with three minims and carrying the dose to twelve minims, or until the pulse begin to display indications of its deleterious influence. The advantage of this practice is, that it enables us to gain time, by checking suddenly the flow of blood, and to take measures for the employment of more permanent remedies. In palpitation of the heart, Brera, Heinsken, and others, have prescribed Hydrocyanic Acid: but the experience of Bally, and many others, as well as my own, is at variance with this opinion; indeed, I have never seen the smallest advantage derived from its employment in palpitation arising from Hypertrophy, or any other cause.

In affections of the mucous membrane, Hydrocyanic acid is a much less equivocal therapeutical agent than in the diseases already mentioned. In chronic Bronchitis, the object is to anticipate those organic changes which render the disease utterly hopeless, to moderate the circulation, to deaden sensibility, and to allay that mobility of the respiratory muscles which greatly augments the frequency and the length of the paroxysms of coughing. In my opinion, Hydrocyanic Acid is well adapted for fulfilling the latter indications, particularly in those cases which simulate Phthisis, and in which Digitalis, which is more

frequently prescribed, has a tendency to disorder the stomach and digestive organs. It is still more decidedly indicated when the disease has extended to the mucous membrane of the stomach and bowels, evidenced by a florid tongue, tender epigastrium, frequent thirst, parched skin, and nightly accession of fever. Indeed, it was by observing its powerful influence in irritable gastric dyspepsia, which induced me to give it in this form of chronic bronchitis. It operates locally on the digestive organ; allays its irritability, and thereby favours a slower, and consequently a more healthy, secretion of the gastric juice, whilst, at the same time, it stills the cough. In these cases, it is most useful when combined with Liquor Potassæ in the Bitter Almond emulsion: it may be given in doses of three or four minims with twenty or thirty of the solution of the alkali, in f℥iss of the emulsion, every fourth or sixth hour.

In irritable gastric dyspepsia, characterized by an uneasy or painful sensation at the pit of the stomach, aggravated after taking food, and by acid eructations occurring during the process of digestion; by the pain being rather relieved than increased by moderate pressure, indicating little or no inflammation; the tongue clean or only thinly furred; and the mind constantly and exclusively directed to the uneasy sensations; hydrocyanic acid may be regarded almost as our sheet anchor. I directed the attention of the profession to the salutary influence of Hydrocyanic Acid in this condition of the digestive organs in 1818; and its efficacy was soon afterwards most amply demonstrated in an extended series of clinical cases, treated chiefly in Saint Thomas's Hospital by Dr. Elliotson, who laid the results of his experience before the Profession, in a volume published in 1820.

When an inflammatory state of the mucous membrane exists, indicated by the tongue being red at its margin, and frequently having round spots or points of a darker red distributed over it, interspersed through a brownish, slimy fur, and more tenderness over the epigastrium than spasm can account for, the acid is rejected from the stomach; and, therefore, it is requisite to premise its employment by bleeding, either by means of leeches or cupping over the epigastrium. In such cases, I am in the habit of ordering, after the topical bleeding, two or three minims of the acid, either in the decoction of Iceland liverwort, or Infusion of Columba, or the Solution of the Extract of Sarsaparilla, three times a day, with the best effects. The dose may be gradually augmented until it cause nausea or giddiness; on the appearance of which, it must be diminished to a smaller quantity than that which had previously agreed with the stomach. By thus acting on the nerves of the stomach, and diminishing their irritability, whilst the condition of the bowels is attended to, counter-irritants applied, and relaxation from the cares and anxieties of life obtained, the value of Hydrocyanic Acid in this form of

dyspepsia is rendered most striking. It has been, also, recommended in Dysentery, in combination with alteratives: but its utility is much more equivocal than in that form of Dyspepsia to which I have directed attention.

It is in spasmodic affections, as may be readily supposed, that the therapeutical influence of Hydrocyanic Acid is most conspicuous. In true Spasmodic-Asthma, even when the pulse is small, irregular, and indicating considerable debility, I have seen it act almost instantaneously in relieving the oppressed condition of the pulmonary circulation, and restoring the free action of the respiratory organ. Some of the benefit in this case, however, is probably due to its influence on the stomach, which is always in a highly irritable condition, and, added to the flatulence which generally accompanies this dyspeptic affection, greatly augments the embarrassment of the respiration. In the second or spasmodic stage of Hooping-cough, especially when it is complicated with an irritable state of the alimentary canal, the beneficial effects of this acid are most conspicuous. In recent writers on this disease, however, we are cautioned against employing it in the Hooping-cough of children: but this is unnecessary, if ordinary caution and discrimination be displayed in its administration. My plan is to clear the stomach with an emetic, and the bowels with a brisk cathartic; after which the acid is given, in doses from m. i to m. ii in the bitter almond emulsion, sweetened with a little syrup of Tolu, twice or three times a day. In ordinary cases, it is seldom necessary to change the prescription, unless to augment the dose of the acid: the cough gradually abates in violence and frequency; and, in scarcely any instance, unless the cough has been complicated with an hereditary predisposition to tubercular Phthisis, or to Hydrocephalus, or some other disease, have I seen it run on beyond a month or five weeks. If a tendency to inflammatory action in the chest display itself, the measures necessary to be adopted need not interfere with the use of the acid.

In all cases, unless in the middle of summer, it is proper to confine the little patients to a graduated temperature, and restrict them in food to a milk and vegetable diet.

These remarks on the therapeutical use of Hydrocyanic Acid apply in all respects to the oil of Bitter Almonds, and laurel water, which have been occasionally substituted for it. Twelve minims of the oil dissolved in one fluid drachm of Olive oil, and formed into an emulsion with mucilage of gum, is thought equivalent to four minims of the Hydrocyanic Acid. In treating chemically of this oil, I pointed out the fact of its containing a volatile oil, having the odour of the Peach blossom, which acted on the animal œconomy, independent of any Hydrocyanic Acid united with it. It is this oil which affects some individuals of a peculiar idiosyncracy, causing an eruption on the skin closely resembling nettle-rash, which is an objection to the employment

of it; and, on this account, the free Hydrocyanic Acid is preferable to the oil of Bitter Almonds, as it does not produce this effect in the same individuals.

A more useful substitute for the Hydrocyanic Acid than the oil of Bitter Almonds, is the Cyanide of Potassium. One part of the Cyanide and eight of distilled water form a solution equal to the medicinal Hydrocyanic Acid; and which may be administered in the same doses. It causes, when applied to the skin, a sensation of cold, which, however, is soon followed by a pricking or tingling in the part; the skin becomes red; and, if the application be continued for several days, erythema or eczema is apt to supervene. It also operates generally, lessening the force and the frequency of the pulse: an effect, however, which varies in those labouring under fever. It sometimes, also, causes a tendency to sleep. As an external application, an ointment made with this Cyanide, in the proportion of gr. v or gr. x to ℥i of lard, or a lotion made with gr. viii or gr. x, in an ounce of water, has been employed in neuralgia and sciatica. The lotion is preferable to the ointment. A compress of lint moistened with it should be applied over the pained part; and renewed as soon as it becomes dry. The application should be continued for several days after the pain is gone. It has been found, also, to allay headache, when it is applied to the scalp.

The external employment of the Hydrocyanic Acid in the Bitter Almond emulsion, has been found very serviceable in Impetigo and other eruptions attended with much itching and irritation.

The next group of Sedatives, the preparations of Tobacco, possesses great power.

The employment of Tobacco is generally in the form of Enema, made by infusing ʒss to ʒi of the Tobacco in a pint of hot water: but there are few cases in which so strong an infusion is required; and it is always safer to employ it of half the strength: indeed, several cases are on record in which fatal effects have resulted from the stronger infusion. Its effects are great muscular relaxation, partial insensibility, nausea, cold clammy perspirations, and faintness. It is chiefly employed to relax spasm. In Tetanus, which consists of rigid spasms of the respiratory and spinal muscles, it has been administered with much advantage, even when the disease has resisted the most powerful antispasmodics. One of the chief, and the most distressing, of the symptoms in Tetanus, is pain under the sternum, arising from the spasmodic action of the diaphragm; it is this symptom which the Tobacco enema most rapidly and effectually removes. In a case detailed by Mr. Alexander, of Liverpool, in which the disease arose from a wound in the finger, which brought on emprosthotonos, the spasms were completely subdued by the administration

of two tobacco enemas. In Dysuria, from calculi impacted in the urethra, the effects of the tobacco clyster are most strikingly beneficial: the effects are sickness, some vomiting, and vertigo: after which, the calculus generally passes. It is remarkable that the use of the Tobacco is not set aside in cases of suspended animation: neither is its employment in incarcerated hernia to be hastily resorted to; as it has been ascertained that, in cases in which it has not succeeded, and which have required the operation, the cure has been less rapid, and has proceeded with less regularity, than when it has not been employed.

In spasmodic asthma, there is a permanent alteration of the mucous membrane of the bronchi, which renders it morbidly sensible to the impression of external influences. It is this which causes the return of the paroxysms of the disease, on the incidental application of substances which are suspended in the air to the bronchial membrane; and hence we might, a priori, expect that, due care being taken to apply topically remedial agents, the opposite of those which are the exciting causes of the paroxysm would be followed by beneficial results. The smoking of Tobacco has been employed for this purpose with considerable advantage: but, if the custom be regularly indulged in, smoking soon ceases to produce any beneficial result as a sedative in these cases.

Little requires to be said respecting the two next groups of Sedatives. The Hydrosulphuret of Ammonia was employed by Dr. Rollo and Mr. Cruikshanks, in Diabetes mellitus, to destroy the ravenous appetite and morbid energy of the digestive organs which more or less accompanies that disease. It operates by a direct influence on the nerves of the stomach; and in doses of even five minims, in a tumbler of water, it causes nausea and vomiting; and when the dose is larger, drowsiness and vertigo supervene. Although its influence in this respect is undoubted, yet, Hydrosulphuret of Ammonia has been rarely prescribed. The same opinion may be delivered respecting the gases, which are compounds of Sulphur and Hydrogen, and Carbon and Hydrogen. The latter, in particular, has been employed in Phthisis, diluted with twenty or thirty times its bulk of common air: it causes nausea, giddiness, and other symptoms of depression, and thus relieves the irritable cough so distressing in Phthisis: but even in this diluted state it is not wholly devoid of danger, and consequently it has not been generally recommended.

The sedative influence of Carbonic Acid Gas has been well ascertained. When the body of an animal is immersed in an atmosphere of this gas, whilst atmospheric air is supplied to the lungs, sedative effects, such as dimness of sight, singing of the ears, vertigo, and depression of muscular power, ensue: it has even a decided topical influence in allaying morbid sensibility. Dr. Priestly having excited pain in a blistered part by immersing it

in Oxygen, relieved the pain, instantly, by plunging the hand into a jar of Carbonic Acid Gas. The sedative influence of this gas explains the soothing effect of carrot and fermenting poultices in open Cancer: and that it is the carbonic acid which is the sedative agent, is readily demonstrated by directing a stream of the gas on such sores. It can, however, be regarded only as a palliative in these cases, and as capable of checking for a short time the progress of the Cancer. On this account, it was at one time much employed in tubercular Phthisis. Dr. Percival made the most extensive series of experiments with it in this disease. "The hectic fever was in several instances greatly abated, and the expectorated matter rendered less offensive: but I have not," he adds, "been so fortunate in any one case as to effect a cure; although the use of the mephitic air has been accompanied with proper internal medicines." Dr. Withering seems to have succeeded in curing one case of vomica: "it corrects," says he, "the fœtid smell of the matter, and very shortly removes the hectic fever." Favourable opinions also of Carbonic Acid Gas inhaled into the lungs, in Phthisis, have been recorded by Dr. Dobson, Dr. Hulme, Dr. Beddoes, and Dr. Fenwick of Durham; but my own experience has not permitted me to form a favourable opinion of it, as a sedative, in this disease. When it is employed, it should be diluted with four parts of common air.

The only indirect sedative which we have to examine, in reference to its therapeutical powers, is blood-letting.

In whatever manner blood is abstracted in inflammation, there is only *one object* to be attained,—namely, a sedative impression on the habit.

It is of importance to know that inflammation of serous membranes, and the parenchyma of organs—for instance, the substance of the brain—protects the system from feeling the loss of blood: intestinal derangements have the contrary effect. Dr. M. Hall imagines that this difference may depend on the diseases inducing different states of the blood. Inflammation augments the proportion of albumen and fibrin, and induces the appearance of the buffy coat: chylopoietic derangements induce the very opposite state of the blood.

In every form of Fever, the expediency of using the lancet, as a sedative, is to be considered. In simple Fever, unless the patient be plethoric, or symptoms of excitement display themselves, it is not required; and even when it is advisable to resort to it, with the view of preventing local inflammation, the abstraction of blood should be moderate, and at the very commencement of the disease. If there be determinations to particular parts, then its therapeutical influence is undoubted.

In Intermittent Fever, blood-letting was formerly much employed. The practice originated in an idea that a morbific

matter exists in the blood, and is the cause of the fever, and consequently requires to be evacuated by means of the lancet. Something like this opinion has been revived by the theory of Dr. Stevens, although it does not lead to the employment of the lancet, to change the morbid condition of the circulating fluid. Whatever may be the sources of this fever, whether *aqueous vapour* applied to the surface, or *marsh miasma*, it is a disease connected with debility and morbid irritability; consequently, whatever tends to increase these conditions of the system must favour the continuance of the disease. The Agues of warm climates, however, are exceptions to this rule; they usually demand depletion, both local and general; and at Rome, where they are prevalent, the treatment is always commenced by blood-letting from the arm.

When Agues resist emetics, calomel, and antiperiodics, the power of the latter is often increased by a general bleeding: but on no correct principle can the indiscriminate use of the lancet be authorized in Agues: indeed, when bleeding has been resorted to, it has generally rendered the disease more obstinate than usual. It has, also, tended to superinduce other diseases; as, for instance, Dropsy, and that state of plethora which indicates a greatly diminished vigour of body. Nevertheless, Dr. Macintosh, of Edinburgh, proposed to bleed in the cold stage of Ague, and published eight successful cases of the practice (in the 27th and 28th vols. of the Edin. Med. and Surg. Journal). Four of the cases were certainly cured by this means: but they were cases of long-standing, and complicated with visceral inflammation. The object of Dr. Macintosh, in using the lancet, was to overcome the congestion which occurs in the cold stage of the disease. The practice was put to the test by Dr. Stokes, Dr. Haviland, in the Infirmary of Cambridge, and by Mr. Gill; but the results were unfavourable. Circumstances, however, may occur to render the use of the lancet necessary in Ague. Thus, when the disease appears in spring, it is often complicated with the inflammatory diathesis, a disposition of body which always prevails at that season, and demands blood-letting at the commencement of the attack. When Ague is complicated with abdominal or thoracic inflammation, one general bleeding may be requisite; but topical bleeding is more likely to prove beneficial, and is usually resorted to. Before general bleeding is decided upon in Ague, the *age*, the *constitution*, the *habits*, and the *situation*, of the patient must be considered. If a man, in whom the diathesis may authorize blood-letting, lives in a damp place, he will be much less able to bear the sedative influence of the loss of blood, than he who, under similar circumstances, lives in a dry one. Blood-letting is equally injurious in those multiform diseases which have been termed *Masked* Intermittents, solely from their assuming a periodic type.

The type of real Intermittents, also, determines the propriety of blood-letting when the inflammatory diathesis prevails. Thus, under such circumstances, *quotidians* are more likely to require it than *tertians;* these than *quartans:* but the nature, or *genius*, as Sydenham termed it, of the prevailing epidemic must be studied, and our measures taken accordingly. The nature of the season, also, must not be overlooked. If the disease occur after long-continued rain, it often assumes the typhoid type, in which state blood-letting would prove hurtful.

When all circumstances concur to recommend blood-letting in Ague, we should enquire in what stage of the disease it is most likely to prove beneficial: whether during the paroxysm, or in the interval. As already stated, it has, in a few instances, proved beneficial in the cold stage; but it is rarely indicated at that time, as the vital powers are then depressed; and in the sweating stage it is equally improper, as the system is then exhausted: if it be used at all during the paroxysm, it should be in the hot stage, when the pulse is quick and hard, when there is intense headache, suffusion of the eyes, delirium, and great thirst. With respect to the quantity to be taken away, this must be determined by the power of the system, indicated by a tendency to, or freedom from, syncope, when the patient is bled in the erect posture. As a general rule, however, blood-letting should be very sparingly employed in Agues. In the interval, if the disease be complicated with hepatic or with splenic inflammation, local bleeding on the hypochondria may be advantageously employed: and, although this form of depleting is intended to operate as a sedative, yet it may be promptly followed by the use of the Salts of Quina, and other antiperiodics. The use of other Sedatives is still more exceptionable. In making this remark, however, it is necessary to state that the Bitter Almond emulsion, which owes its properties to Hydrocyanic Acid, has been used successfully in intermittents, even in cases where the bark failed; and Dr. Brown Langrish used to cure Agues with the distilled water of the Prunus *laurocerasus*.

If that pure inflammatory fever designated Synocha by Dr. Cullen exist, there can be no question as to the propriety of abstracting blood in it: but, as continued fevers are generally of a typhoid character, many circumstances ought to be enquired into before blood-letting be employed; and the sum of medical opinion is against it. Not only the constitution of the patient, but the state of the atmosphere, must be taken into account; for, as Inflammatory Fever sinks into Typhus, so this fever sometimes suddenly changes its character and displays an inflammatory type. Thus, in the British army in the Peninsula, Typhus, in the hospital at Bilboa, while the atmosphere remained sultry and relaxing, assumed characters directly the reverse of those indicating venæsection; but as soon as the weather

changed, and frost set in, the change of type, says Dr. Hennen, "pressed on our consideration the propriety of blood-letting. This was rendered obvious by the fact, that spontaneous hæmorrhages, which formerly sunk the patient's strength, were now accompanied with obvious relief*." In Synochus, blood-letting is indicated in the early stage of the disease, and may be repeated according to the manner in which it is borne; but if the disease have run on for a few days, an irremediable degree of exhaustion is likely to follow blood-letting. As a general rule, the Continued Fevers of warm climates require the use of the lancet less than those of temperate climates; and still less than those of cold climates. In large towns, Fevers require less the use of blood-letting than in the country; in damp situations than in dry; and in crowded hospitals than in private practice.

The nature of the exciting causes will also affect the consequences of blood-letting in Continued Fever. If inflammatory symptoms occur, topical blood-letting may be employed; and it should be laid down as an axiom, that recourse should never be had to general blood-letting unless symptoms strongly indicate the phlogistic diathesis. When the exciting cause of the fever is cold, the vascular action is generally considerable, it lasts longer, and the attack seems more to require bleeding than in the severer forms of Continued Fever. Epidemics differ, not only in their nature, but in their consequences; and therefore require different treatment: in some, every circumstance would seem to point out the propriety of blood-letting; yet it will prove injurious; and sometimes, when the propriety of the measure is less obvious, it is better borne, and is productive of benefit.

In pure Inflammatory Fever, blood-letting, as a Sedative, may be employed at any period of the disease: in Typhus, the commencement is the most proper period; but in mixed fevers it is difficult to fix the proper time, as the limits of the inflammatory portion of the disease and its opposite state are difficult to be determined. As a general rule, however, the earlier in disease the bleeding takes place, the better, and the safer; the more precarious, and the greater the risk, the longer the attack has continued. In mixed fevers, the symptoms denoting the propriety of blood-letting are a frequent, full, hard pulse, increased thirst, a high temperature of the body, determination of blood to the head, and delirium of the phrenitic kind: it is also indicated if any determination to the lungs exist, manifested by cough and embarrassed or difficult breathing; or to the abdomen by pain and tension: but, even when these symptoms are present, it may admit of a question how far the use of the

* Hennen's Observations on Military Surgery, &c. 8vo. 1818—p. 245.

lancet is advisable in this fever. In fixing the quantity to be drawn, as it is upon that that the sedative effect depends, much discrimination is requisite: it must ever be borne in mind, that Fever is an affection of the whole vascular and nervous systems, and, even when symptoms of high excitement display themselves, still the disease differs from pure inflammation, and that syncope is more readily produced by blood-letting in this state than in pure inflammation. In inflammation, there is much less susceptibility of the nervous system, and larger abstractions of blood are borne in it with impunity; but, in the reaction of Fever, stout men frequently faint on being bled even to a very moderate amount: nevertheless, when local inflammation is superinduced, the same individual will bear a larger quantity to be taken without fainting. There is, in fact, in every form of Fever, a strict alliance between the degree of tolerance of loss of blood and the exigencies of the cure.

In the Phlegmasiæ, blood-letting constitutes the most important curative agent. Still, however, the abstraction of blood is to be resorted to with caution: for it is a well-known fact, that the moment the protecting influence of inflammation ceases, or is withdrawn, further blood-letting is in the highest degree dangerous. When the inflammation is extreme or diffused, the whole nervous system becomes severely affected; nevertheless, from the protecting influence of inflammation, general blood-letting is indicated, and it is well borne; but, after a certain time, the abstraction of blood exhausts the powers of the system, and sinking supervenes. Syncope does not always subdue the reaction in severe inflammation; but it is subdued by repeated or excessive syncope: and in this respect inflammation of an active kind differs from Fever, in which syncope at once subdues all the action. A much larger quantity of blood may be abstracted without risk in inflammation than in Fever; but we must, at the same time, remember that the remote effects of excessive blood-letting are apt to supervene the moment the inflammatory action is subdued. No mistake is so dangerous as to bleed after the inflammation has subsided, with the view of preventing its recurrence.

In erysipelatous inflammation, the propriety of employing blood-letting as a general Sedative depends on the type of the attending Fever. If it be of the inflammatory kind, moderate blood-letting is indicated. Topical bleeding, however, which was formerly deprecated, has of late years been found to be highly serviceable; and the best mode of taking blood in such cases is from scarifications of the inflamed parts. My experience has also informed me, that, when the erysipelas attacks the head, blood-letting is rarely required; on the contrary, decoction of Bark with Calomel, and the topical application of a strong solution of Nitrate of Silver to the whole of the inflamed part,

prove much more serviceable than blood-letting or any other sedative. If the attending Fever be of the typhoid kind, it is unnecessary to say that blood-letting would be injurious.

In Ophthalmia, general blood-letting is not frequently required; topical bleeding with leeches, if early resorted to, being sufficient to subdue the inflammation: but, when this is deep-seated, with swelling, intense pain, and intolerance of light, when the pulse is full and hard, not only venæsection, but arteriotomy, so as to induce repeated syncope, will be found necessary. If local bleeding only be indicated, and the inflammation have run on for some days, cupping, as it abstracts the blood more rapidly than leeches, is to be preferred. Scarification of the inflamed vessels, however, is better than either. When the pain is acute, I have seen much relief obtained from the topical application of the Hydrocyanic Acid, very largely diluted.

In Cynanche Trachealis, Croup, blood-letting, carried at once to syncope, in the commencement of the disease, often arrests its progress. Some practitioners draw the blood from the jugular vein, others prefer cupping: but the principle is the same; by a sudden abstraction of blood, to produce a powerful *sedative* effect on the arterial system, and thus subdue the local inflammation. With respect to the quantity of blood that may be drawn from children, we find that a child of five years of age cannot easily support the loss of more than five ounces at a time; one of seven or nine, eight ounces. If the inflammation still continue, blood should be taken by leeches, applied on the upper part of the sternum: but not more than four should be applied on a child under five years of age; nor more than ten on one twelve years old.

The term *Pneumonia* is generic of all the inflammatory attacks of the substance of the lungs; and, in these, the general abstraction of blood is more or less demanded. In inflammation of the substance of the lungs, the blood-letting should be prompt, copious, and repeated: but it should be confined to the early stages of the disease. The extent of the quantity of blood to be lost can neither be foreseen nor indeed ordered by the physician, who, in every case, should witness the operation and regulate the quantity by its effects: as an average quantity, in an adult, less than from thirty to thirty-five ounces will seldom prove serviceable. In that state of pulmonary inflammation, which has been termed bastard Peripneumony, Peripneumonia *notha*, blood-letting is generally regarded as hurtful: it frequently occurs in broken-down habits, and in those addicted to the abuse of spirituous liquors. Some discrimination is requisite to recognize the disease in the commencement: it differs from Pneumonia in the character of the cough, which is short, with copious expectoration, and little or no fever. As it proceeds, the cough increases in violence, the breathing becomes more

difficult, the expectoration less, whilst the face assumes a livid hue, the air tubes of the lungs are choaked up with a frothy mucus, and suffocation ensues. It is evident that, in such a condition of the lungs, blood-letting, or Sedatives of any description, would prove hurtful; on the contrary, stimulant expectorants are indicated. Pneumonia, attacking old people, is very apt to sink into this state; and in adults, in this disease, the same result may follow the incautious and undue abstraction of blood.

In Pneumonia, if the pain be considerable, there can be no doubt of the necessity of copious blood-letting; but the absence of pain does not denote the contrary. In Pneumonia, also, we are to be guided in determining the propriety of venæsection by the period of the disease. It was formerly an opinion, that, after four days, Peripneumony could not terminate in resolution; but more correct observation has exposed this error; nevertheless, venæsection cannot be too early employed; and a quantity of blood, sufficient to bring on a slight tendency to syncope when the patient is in the erect posture, if taken within the first twelve hours, will often prevent the necessity of further blood-letting. The abstraction of blood, however, is not to be confined to any period; it is to be regulated solely by the symptoms: but we must always bear in mind that there is more to be apprehended from the disease than from the lancet. In the second stage, however, when there is dulness on percussion, and the character of the physical sounds indicates hepatization of the lungs, blood-letting loses that character for efficacy which it justly possesses in the early stages of the disease. The average quantity of blood to be taken, at once, is about thirty to thirty-five ounces: I have seen this quantity abstracted every eight hours, until 140 ounces were lost within forty-eight hours, with decided advantage. Much depends on the rapid abstraction of the blood; in this species of inflammation, therefore, more than in any other, a large orifice, with the erect posture, is never to be dispensed with. Such are the advantages of this sedative agent in Pneumonia: it is proper to look at the bad effects likely to follow its abuse. The first bad effect of excessive blood-letting in this disease, is interruption of expectoration, inducing effusion into the lungs, and causing either suffocation or hydrothorax. In the present day, such an effect is not likely to occur; the habit of following a full bleeding with a large dose of calomel and opium superseding the necessity of its frequent repetition. As the principle upon which we must proceed in Pneumonia is applicable to all other Phlegmasiæ, I have ventured to enter a little more into its practical treatment than would otherwise have been requisite.

The use of the unrespirable gases in the phlegmasiæ has been, perhaps, too little attended to: in many respects they might prove useful, from the facility with which they can be ap-

plied to the seat of the inflammation, either when that is external, or confined to the pulmonary system of vessels.

In Pleurisy, blood-letting should be prompt, repeated at short intervals, and the blood drawn from a large orifice, so as to make an immediate and powerful *sedative* impression on the habit. The pulse is here a very *fallible* guide of the quantity to be abstracted: being rather a measure of the irritability of the system than of the extent of the inflammatory action. The quantity to be taken must be determined by the rules already laid down.

In some cases there is, however, an intolerance of bleeding from the first,—a circumstance not easily explained. It occurs in those cases in which the beat of the heart and the pulse are synchronous, as indicated by the stethoscope. In general, the bleeding is well borne. Much caution, however, is required in ascertaining whether the inflammation be accompanied by a *sthenic* or an *asthenic* type of fever: in the former, a powerful sedative impression is indicated; in the latter, it would be deleterious.

By writers on this disease we are told that syncope should always be produced: but this rule might be productive of risk. This is well exemplified in the case of Mr. Lawrence. When syncope does not occur until sixty or seventy ounces of blood have been taken, the flow of the blood should be stopped: but a large abstraction at first is more likely to produce a permanent sedative effect, than small repeated bleedings as usually practised on the Continent. In every instance, pleuritic inflammation tends more to produce *disorganization* than to terminate in resolution; hence the necessity of a powerful sedative effect being produced in the first instance. In this case, the value of the stethoscope in pointing out the propriety of repeating the bleeding is great. When the disease has run on for some days, blood-letting may still be useful—to influence the capillary circulation, by lessening that of the larger vessels: hence checking further effusion of coagulable lymph, and leaving the absorbents to carry off that which is already thrown out. At one time the medical world was divided in opinion whether the blood should be taken from the pained side or the opposite: the Emperor Charles IX was appealed to; but, before he delivered his judgment, he was bled for Pleurisy and died; and his death was ascribed to the blood having been drawn from the wrong side. The controversy ran still higher; and ended, as all such disputes usually do, without either party being convinced; and both remaining a mark for the finger of derision in future ages:—Sanin? creta an carbone notandi?

In *active* internal Hæmorrhages, Sedatives are indicated, and, of course, blood-letting. The object is to diminish the force of the heart and arteries, to lessen general plethora, and to unload especially the suffering organ. This fact cannot

be too strongly impressed on the mind of every practitioner, that the blood, which constitutes Hæmorrhages from the interior of the body, very seldom flows from ruptured vessels. In cases of fatal Hæmorrhages from the stomach and intestinal canal, the greatest pains have been taken to discover ruptured vessels, but without success; no breach of surface, nor alteration of texture can be detected. The conclusion, therefore, is that the blood escapes from the vessels by exudation in every case of idiopathic hæmorrhage. It is unnecessary for our purpose to enquire whether local plethora produces Hæmorrhages; the facts of many cases are in favour of such an opinion; but when general plethora also is present, those *active* Hæmorrhages occur which demand the employment of the lancet. During the flowing of the blood, although blood-letting be often resorted to, yet it is not always necessary, when the quantity of blood lost is great, as the Hæmorrhage will cease as soon as the quantity of blood lost brings down the plethoric state which induced it. The use of the lancet is generally more useful in the intervals, and to anticipate the attacks; and, at these times, the bleeding should be carried to syncope: " the method and the amount, and the repetition of the blood-letting," as Dr. Watson justly remarks, " must of course be regulated by the circumstances of each particular case*." If blood-letting be advisable during the hæmorrhagic flow, the same rule should govern its abstraction as at other times,—namely, to bleed to syncope, as then the Hæmorrhage stops; the object being, not merely to diminish the force of the pulse, but to divert the current of the blood from the suffering organ.

If there be reason for supposing the rupture of a blood vessel, the bleeding to syncope affords time for a coagulum to form over the orifice, the mode which Nature adopts to stop these discharges. In passive Hæmorrhages, blood-letting is contraindicated; and so are all other sedatives. Hence, in those which have been termed vicarious, and which display themselves by vomiting of blood, or the expectoration of blood, in women when the menstrual discharge has been suppressed, when the pulse remains natural, and the general health is little affected, blood-letting is not indicated.

In Phthisis, small and repeated blood-lettings have been much recommended. It is, however, in the commencement only of the disease that even these are admissible. This mode of treatment was introduced by Dr. Dovar: he at first bled to ℥vi every day, for the first fortnight; after which he extended the intervals to two, three, and four days, for three successive fortnights†. A variety of opinions have been given of this plan;

* Cyclop. of Pract. Med.—art Hæmorrhage.
† The Ancient Physician's Legacy, by T. Dovar, M.D. 1733, p. 26.

the celebrated Mead speaks strongly in favour of the practice*: Sir John Pringle had much confidence in it in the early stage of the disease, when there is a sensation of constriction in the chest, and the patients are hot and restless at night: Dr. Monro, another army physician, also adds his testimony in favour of small bleedings at an early period. Stall considered it the best remedy that could be employed; and Dr. Hossack affirms that he used it with the happiest effects, even when the disposition to the disease was hereditary†. The most recent opinion is that of the late Dr. Cheyne of Dublin, who regarded it as likely to allay the inflammatory irritation of incipient tubercles. But in this deplorable malady, however, the existence of inflammatory action is seldom evident; and when it is, local bleeding is to be preferred to general bleeding, even in the first stage of Phthisis. In the second stage, when tubercles are already softened, although no remedies, with the exception of emetics, have hitherto availed, yet, it is an undoubted fact that much relief has been afforded by small and repeated bleedings. It is true that Phthisical patients, even after hectic has shewn itself, bear small bleedings well; and several instances are recorded in which such patients have been bled *two hundred* times in the course of a few months, with decided advantage. But, after all, when we inquire what experience has determined on this point, we find that it would be difficult to affirm that any good, beyond transitory ease, has been afforded to the patients.

In acute *Dysentery*, there can be no doubt of the existence of inflammation; hence blood-letting naturally presents itself as a remedial agent. If the general fever be accompanied with a frequent and sharp pulse, blood should be freely and largely drawn from the arm, and followed by the application of leeches to that part of the abdomen which feels tender on pressure It is seldom necessary to repeat the general bleeding: but, on the principle that inflammation is more benefited by local bleeding than venæsection, leeches may be applied daily whilst any fixed abdominal pain remains. I have seen no case of Dysentery which has required bleeding to a considerable extent: on the contrary, after the first general bleeding, leeches always prove more beneficial than the lancet.

In many instances, *Dropsy* is the result of inflammation in some organ; in which case, bleeding must by all means be resorted to, and carried far enough to affect the system: indeed, not to proceed farther with details, it must be regarded as essential, whatever may be the form which this disease assumes, if inflammatory action be obvious, to employ the sedative influence of blood-letting, carried to an extent sufficient to reduce

* Monita et Præcepta Med. c. 1, § x.
† American Med. and Phil. Reg vol. ii, p. 470.

the pulse, to produce faintness, and thus to change excessive into healthy vascular action.

In *Apoplexy*, blood-letting is resorted to both during the paroxysm and in the interval, from the idea of congestion in the head: but Apoplexy may originate from causes depressing the powers of life, without the presence of congestion. When plethora exists, with an evident determination to the head, the lancet must be employed: but, even in this case, if the disease occur in advanced life, or in debilitated habits, excitants are more likely to prove salutary than the sedative influence of blood-letting. In such cases, however, topical bleeding is indicated.

In *Mania*, blood-letting has often done harm: for although the state of the brain approaches to that in Meningitis, yet experience has demonstrated that Mania cannot be regarded as inflammatory. Bleeding, says Pinel, may ward off or arrest an anticipated attack of recurrent madness; but when the disease has actually broken out, even when Mania is accompanied with symptoms which indicate plethora, and a determination to the head, blood-letting tends to retard recovery, and to render it more doubtful. It tends to a degeneration into fatuity: indeed, this is what might be anticipated, since too copious bleeding, even in a subject not predisposed to Mania, nor labouring under the disease, is very likely to induce a fatuitous dejection of mind. Esquirol coincides with Pinel, and my own limited experience accords with that of these distinguished physicians; yet, Cullen, Haslam, Quesler, Foville, and others, have maintained an opposite opinion. Rush, in particular, advises large and repeated bleedings, carried to syncope; and, after general bleeding, the application of leeches and cupping-glasses to the head or nape of the neck. Dr. Prichard justly doubts the propriety of these copious bleedings, and considers that much danger to life would be incurred, in many instances, were they generally practised: but he approves of the moderate abstraction of blood, particularly when the disease has made its attack suddenly, "unless circumstances connected with the age, habits, or temporary condition, of the patient, render it unsafe. It is required, Dr. Prichard thinks, when there is a constant agitation and want of sleep, with full, throbbing carotids and temporal arteries, redness of the face and conjunctiva, heat of the scalp, a contracted pupil, intolerance of light and of sound, headache, vertigo, and convulsions. Even, if a few of these symptoms only be present, the necessity of employing such a sedative as blood-letting cannot be doubted; but, nevertheless, in the more ordinary attacks of Mania, the use of the lancet is not called for. When suppression of the catamenia, or bleeding piles, or other customary evacuations, take place, and augment the maniacal symptoms, then either general bleeding, or the application of leeches to the hemorrhoidal vessels, is requisite, to supply the defect of the habitual method of relief.

In *Puerperal Mania*, all writers concur in condemning blood-letting. As I have little to advance, from my own experience, in the management of this disease, I cannot do better than quote Dr. Gooch's opinions on this subject. "The result of my experience," says he, "is, that in puerperal Mania and Melancholia, and also in those cases which resemble Delirium Tremens, blood-letting is not only seldom or never necessary, but generally almost always proves pernicious. I do not say that cases never occur which require this remedy; no man's experience extends to all the possibilities of disease; but I have never met with such cases, and I would lay down this rule for the employment of blood-letting, never to use it as a remedy for disorder in the mind, unless that disorder is accompanied by symptoms of congestion or inflammation of the brain, such as would lead to its employment though the mind was not disordered. Even here, however, great caution is necessary; *local* is safer than *general* blood-letting."—"In the really inflammatory diseases of the brain, blood-letting is of course essentially necessary; but these, I think, can never be mistaken for puerperal insanity; they are febrile headaches more or less acute. Pain of the head with fever is a much better indication for blood-letting than disorder of the mind without the symptoms."

In spasmodic and convulsive diseases, which generally depend on increased irritability, whatever favours weakness is to be avoided; thence blood-letting is not usually called for. When simple irritation is the cause of inordinate action, blood-letting is certainly not required: but when spasm is complicated with an inflammatory state of the habit, it must not be neglected. It must, however, be admitted that it is difficult to draw a line between these two states. When there is a determination of blood to particular parts, even when the inflammatory diathesis is not present, local blood-letting, by cupping or by leeches, is requisite.

Before bringing these remarks on blood-letting to a close, it is necessary to review its therapeutical value in *Hypertrophy* of the heart, a disease, the knowledge of which is of modern date. As it consists of an increased nutritive power and action of the heart, sedative means are indicated, and of these, blood-letting as one of the most efficient. Laennec recommends, in the commencement, copious blood-letting carried to syncope, and repeated with intervals of a few days only, until the palpitations have ceased, and the heart gives only a moderate impulse to the stethoscope: at the same time, that the food is reduced to half its usual quantity, and all stimulants are interdicted. He carries this plan to its utmost extent, even when the Hypertrophy is accompanied with extreme Dyspnœa, with Anasarca, and with other symptoms of great debility. My experience is at variance with this plan of Laennec. I have not observed any permanent

beneficial result from large, repeated bleedings; no good arises from enfeebling the system, although undoubtedly every stimulant ought to be interdicted, and the exercise should be such as never to hurry the circulation. But although copious blood-letting cannot be recommended, yet, there is a necessity for preserving the blood within due bounds in point of quantity; and to sooth irritability by every means in our power. I have found much benefit derived from the use of a saline aperient every morning; and from three to four drops of Hydrocyanic Acid in a glassful of Infusion of Calumba twice a day. In spasmodic and convulsive diseases, which generally depend on increased irritability, whatever favours weakness is to be avoided; hence blood-letting is not usually called for. When simple irritation is the cause of inordinate action, blood-letting is certainly not required: but when spasm is complicated with an inflammatory state of the habit, it must not be neglected. It must, however, be admitted that it is difficult to draw a line between these two states. When there is a determination of blood to particular parts, even when the inflammatory diathesis is not present, local blood-letting, by cupping or by leeches, is requisite.

We may close these remarks by saying that Sedatives employed with discretion are powerful agents in the hands of the practitioner; abused or employed indiscriminately, if they do not sap the foundations of life, they render it miserable, burthening it prematurely with all the infirmities of a shattered constitution, and the decrepitude of age both in body and in mind.

SECTION V.

REFRIGERANTS.—MEDICAMENTA TEMPERANTIA.

The influence of refrigerants in cooling the body, when its temperature is elevated by disease, is undoubted; the cooling effect which they produce, although experienced at first only on a part, yet, is gradually extended over the body, lowering the sensibility and arresting the mobility of the vascular and muscular systems. But, although the influence of Refrigerants be generally admitted, yet, much diversity of opinion exists respecting the manner in which some of them, namely, those that are taken into the stomach, operate. It is only necessary to allude to two of these discordant theories; that of *Cullen:* and that of the late *Dr. John Murray*: the first on account of the celebrity of its author; the second on account of its plausibility, yet insufficiency to explain the subject.

Cullen's opinion is purely hypothetical, and founded upon a doctrine of Needham; it supposes "that there is every where in Nature an expansive and a resisting power; and that, particularly under a certain degree of heat, the expansive power appears in all the parts of organized bodies, in consequence of which they shew a singular vegetating power; while, at the same time, there is in other bodies a power resisting and preventing the action of the vegetating power, and, at least, of diminishing its force." Dr. Cullen assumes that this power exists in those substances which are usually employed as Refrigerants. It would be a waste of time to comment on this hypothesis.

Dr. Murray founds *his* theory on the presumption of the truth of the theory of Dr. Crawford, that, in the process of respiration, the arteries in the lungs absorb the caloric liberated there; and, owing to the great capacity of arterial blood for caloric, this is instantly rendered latent in their contents, and so remains, until the subsequent conversion of the arterial blood into venous blood, when it is liberated through the system. Dr. Murray supposes that the consumption of oxygen in the lungs, supplying the caloric to the arterial blood, is greatly influenced by the nature of the food and other ingesta received into the stomach; that, when these contain a small proportion of oxygen, the demand for that component of the air, and, also, its consumption in the lungs, is augmented, and consequently the temperature of the body is elevated; whereas the opposite effect takes place when the ingesta contain much oxygen, especially if it exist in a loose state of combination; hence the vegetable acids, Nitrate of Potassa, and similar substances, exert a refrigerant influence when taken into the stomach. There is much ingenuity in this opinion; but its accuracy must stand or fall with the theory of animal heat, on which it is founded: for if the difference of the capacity of arterial and venous blood for caloric, the foundation of Dr. Crawford's theory, be found insuffiicent to account for the temperature of living animal bodies, Dr. Murray's theory of the changes caused in this respect, by the action of internal refrigerants, must fall to the ground.

Dr. Crawford's theory, or rather hypothesis, is purely chemical, founded, as already stated, on the assumed fact, which he endeavoured to demonstrate by experiments,—namely, that arterial blood has a greater capacity for caloric than venous blood, nearly in the proportion of 11·5 to 10. In the act of respiration, according to Dr. Crawford, the carbonic acid, which is developed in the lungs, having a smaller capacity than common air for caloric, must cause an augmentation of temperature: but this is not perceived in the chest, because the blood, changing from venous to arterial, absorbs the heat given out by the carbonic acid during its development. The blood is not, therefore,

sensible of a higher temperature than it was before; on the contrary, the arterial blood in the pulmonary veins is lower in temperature than that in the pulmonary arteries. Thus charged with insensible caloric, the arterial blood, as it circulates, becomes venous, and, losing its gearter capacity for caloric, parts with that which it contains, and thus maintains the supply demanded by the body to sustain its temperature, in the cooler medium in which we live.

Ingenious as this hypothesis is, and numerous as are the facts that might be adduced in its support, it has undoubtedly fallen into disrepute; and, even admitting that animal temperature is a chemical process, it has been found insufficient to account for the phenomena which present themselves, in examining into the quantity of caloric developed by the oxygen which disappears in respiration: and even Dr. Davy has maintained, from Dr. Crawford's own experiments, that there is little or no difference between the capacity of venous and that of arterial blood, the proportion being only as 10 to 10·11; consequently the whole hypothesis, if this be correct, must fall to the ground.

From some experiments carefully conducted by Dulong and Despretz, in which it appeared that the quantity of caloric disengaged by the conversion of oxygen into carbonic acid, is equal in carnivorous animals to between 49 and 55 per cent. of the heat, disengaged by the whole body, during an equal interval of time; and in phytivorous animals, to betwixt 65 and 75 per cent.; and that the whole quantity of caloric, disengaged by the formation of Carbonic Acid and water together, is equivalent to between 69 and 80 per cent. only. Now, if these experiments be correct, it is a necessary consequence that the animal heat is greater than can be accounted for by the fixation of oxygen in arterial blood during respiration; and Dr. Crawford's hypothesis fails in explaining the cause of animal temperature.

A more tenable theory, in my opinion, is that which refers the animal temperature to the influence of nervous energy. This might be almost admitted upon the simple fact, that the destruction of any considerable portion of the spinal marrow lessens the temperature of the body. The chief experiments, on which this opinion rests, were made by Sir. B. Brodie. They go to prove that, when the function of the brain is suspended or destroyed by dividing the spinal marrow, and when the mechanical phenomena of the circulation is then supported by artificial respiration, the consumption of Oxygen, and the formation of Carbonic Acid, are equally great; yet the heat of the animal so treated falls rather more rapidly than that of another, in which the functions of the brain are also destroyed, but the circulation is not maintained by artificial respiration. These results certainly are completely opposed to the ingenious and

beautiful hypothesis of Crawford. It is true that weighty objections have been advanced against the inference drawn from Sir B. Brodie's experiments.

It has been asserted, by other physiologists who have repeated these experiments, that the process of cooling is actually retarded by artificial respiration: and further, that it is inconsistent with the fact, that an increase of temperature, which invariably takes place in other cases during the formation of carbonic acid, should not also occur, within the animal body, during that process in the lungs. In the main, however, as Muller remarks, Brodie's experiments are convincing*.

Whether the nervous energy be the sole source of animal temperature, may be doubted: but it is no longer contended that it has not a considerable share in producing it; and many facts, on record, concur to strengthen this opinion. It is true that most of these facts demonstrate its influence chiefly in augmenting and maintaining the heat of parts; but, if the influence of the nervous energy, in this respect, on distinct parts be admitted, the argument in favour of its power over the whole system is very greatly strengthened. Sir Everard Home divided the nerves supplied to a growing antler of a stag, and found that the temperature almost immediately fell; and although, after a few days, it again rose to a higher degree than in the other antler, yet this did not invalidate the only inference that can be deduced from the experiment; that, in this case, the temperature of the part depended on the integrity of its nerves, and consequently on their influence. In paralysed limbs, the temperature is lower than in healthy limbs, although, in many cases, the circulation in the paralysed limb is unaffected, and the paralysis is confined to the sensibility of the member. In a case detailed by Mr. Earle (in the 7th vol. Med. Chirurg. Trans.), in which the axillary plexus on one side was crushed by a fall, the temperature of the paralysed arm was considerably lowered. The temperature of the hand of the paralysed arm was 70° Faht., that of the sound side 92°. I found as great a difference between the hand of the paralysed arm and of the sound arm, in the case of a patient who died in University College Hospital. Indeed, the fact is well known, that paralysed limbs are more rapidly lowered in temperature by external cold than sound limbs; and that whatever increases nervous action increases temperature. The following inferences may be legitimately drawn from these facts: 1, that an integrity of the nervous system is essential to the evolution of animal heat; 2, that whatever destroys or impairs this integrity, is followed by a partial or general derangement of the calorific function. Perhaps the most correct view

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* Muller's Elements—Trans. p. 87.

that can be taken of the subject, is that which supposes that the nervous energy may either generate heat, or excite certain operations of a chemical nature in the living habit, by which the same effect is produced; but, in either case, a considerable obstacle is presented to the purely chemical theory of Dr. Murray, respecting the mode in which *internal Refrigerants* operate, in lowering the animal temperature. The subject, therefore, remains as he found it; and the question presents itself—can no rational explanation of the operation of substances which produce a refrigerant effect upon the body, when they are taken into the stomach, be suggested? I am not presumptuous enough to imagine that the opinions which I entertain are likely to be generally adopted; yet I conceive that they favour some approach to a correct view of the subject.

In abstracting caloric from the surface of the body, or, in other words, cooling the skin, whatever agent be employed, whether diluted acids, such as vinegar and water, or salts in the act of solution, or cold air, or cold water, or ice, the activity of the capillaries of the part is immediately diminished; and as their action cannot be lowered without the whole vascular system being more or less influenced, the momentum of the heart and the arteries is also materially lessened. The consequence of this depression of the vascular action is immediately felt on the respiration: the blood does not undergo its necessary change to the extent which is requisite; hence, imperfectly arterialized blood is conveyed to the brain, the function of which being thus lowered from defect of stimulus, a condition somewhat resembling slight general paralysis of the nervous system ensues, so that a temporary torpor of every organ whose functions depend on the energy of the brain and nerves must necessarily follow. This fact is daily illustrated by the influence of external cold in producing drowsiness in those who perish from exposure to intense cold. Even the hands of many individuals become numbed, or nearly insensible, when exposed to the air in cold weather; a result which is more likely to arise from the direct influence of cold on the nerves themselves, than from the diminished supply of blood to the parts. Indeed, as, in this case, the effect on the nerves is partial, we can scarcely imagine any other cause of the diminished action of the capillaries than the depression of the nervous energy. Now, if we suppose that an effect resembling that produced on the surface by the application of external cold bodies, or cooling bodies, takes place in the stomach when refrigerant agents are introduced into it, we may readily admit that their influence on the capillaries of that organ may be extended by sympathy over the whole body. The possibility of such a result is equally probable in the one case as in the other; and this opinion receives

some support from the fact, that the Nitrate of Potassa operates as a powerful general *Refrigerant*, if swallowed at the time of its solution in water; but as an *excitant*, when it is not taken into the stomach until some time after it has been dissolved. The sensation of cold which the Nitre causes in the stomach during its solution, is evidently owing to a partial abstraction of stimulus; and the effect of this being extended, through the nerves, to the heart and the larger branches of the arterial system, a general reduction of action follows, and a sensation of cold spreads over the whole body. Again, as the influence of vegetable acids on the surface is to diminish the action of the capillaries, and render the surface pale; so the same diminution of action caused by them on the capillaries of the stomach, operates by nervous sympathy on the rest of the body, and the necessary sequence is a reduction of the animal temperature. We thus advance one step towards an explanation of the action of Refrigerants.

We have now to enquire how far this theory is supported by the known effects of refrigerants upon the functions of the stomach, lungs, and other organs.

1. *Influence of Refrigerants on the Functions of the Stomach.*—In the healthy condition of the stomach, little impression is made upon it by Refrigerants: but, when it is in a more irritable condition, then they allay the sensation of heat, nausea, thirst, and general uneasiness, which irritation or inflammation produces in it. Even when no local inflammation is present, cold water, and other cold bland fluids, received into the stomach, cause a sensation of cold there, and moderate general excitement, and control febrile action: an effect which can only be explained by the influence of Refrigerants on the nervous energy. In a more extensive state of disease, however, when ulceration or cancer exists, Refrigerants cause a sensation of cold, which is painful; at other times, sensations of heat, acrimony, and general uneasiness, owing to the action of the acids on the diseased tissues; hence they tend rather to increase than to allay the sufferings of the patient.

2. *On the Circulating and Respiratory Organs.*—Most of the substances employed as refrigerants are taken into the circulation; but, in a healthy person, they cause no violent change in the action of the vessels,—neither diminishing nor augmenting the force or the frequency of the pulse, nor even that of the capillaries, except in some cases of peculiar idiosyncracy, in which they so powerfully affect the larynx as to cause a temporary loss of voice, or Aphonia. In a state of excitement, Refrigerants moderate arterial action, and relax the tension of the pulse; and their effect upon the minute vessels is especially manifested by the diminished temperature

which follows their administration. This refrigerant influence of acids displays itself in the instinctive desire of fever patients for acidulated fluids, which keeps pace with the augmented degree of the temperature of the body.

Refrigerants do not sensibly affect the respiratory organs in health; but, in the febrile condition of the habit, the influence which they exert on the circulation is necessarily communicated to the lungs. In the diseased state of these organs, many Refrigerants, particularly the vegetable acids, augment cough and oppress the breathing, if they are administered before the inflammation is lowered, and the morbid susceptibility of the mucous membrane is diminished. After this is affected, we still perceive their action on the mucous membrane, by the influence they exert on expectoration.

3. *On the Secerning System.*—The action of Refrigerants upon the secreting organs seems to be confined to the kidneys: the quantity of urine is greatly augmented; but this seems to be altogether independent of the refrigerant effect which the substances belonging to this class of medicinal agents produce upon the skin.

4. *On the Nervous System.*—Although little effect be produced upon the nerves by the introduction of refrigerants into the stomach, in health, yet, in diseased conditions of the spinal cord, the whole organic tissues are rendered more susceptible of impression by the administration of vegetable acids. I once witnessed a remarkable case of this kind, in a person who was labouring under subacute inflammation of the theca of the spinal cord. Whenever he swallowed an ordinary effervescing draught, he immediately suffered from a sensation of pricking over the surface; the skin could scarcely be touched, it was so sensitive; and the whole habit was restless and uneasy. Hypochondriacal and hysterical persons not unfrequently suffer in a similar manner from the use of acids. This might be ascribed to idiosyncracy, were it confined to particular individuals, which is not the case.

Refrigerants operate generally as sedatives, and their cooling influence is extended from the stomach to the whole system. They may be regarded, therefore, as acting either on the organic functions, or on the sensibility of the body.

TABLE OF REFRIGERANTS.

A. REFRIGERANTS OPERATING ON THE ORGANIC FUNCTIONS.

ORGANIC SUBSTANCES.

a.—Vegetable Acids—

	Combined—as a distinct secretion.			
Herb——	Oxalis *acetosella.*	10.	4.	Oxalideæ.
	Rumex *acetosa.*	6.	3.	Polygonaceæ.
Fruit——	Citrus *limonum.*	18.	3.	Aurantiaciæ.
	—— *Aurantium.*	—.	–.	————
	—— *medica.*	—.	–.	————
	* Feronia *elephantum.*	—.	–.	————
	Tamarindus *Indica.*	16.	1.	Leguminosæ.
	Vites *vinifera.*	5.	1.	Vitaceæ.
	Morus *nigra.*	21.	4.	Urticaceæ.
	* Ficus *religiosa.*	—.	–.	————
	* Berberis *vulgaris.*	6.	1.	Berberaceæ.
	Uncombined.			

b.—Acetic Acid.

INORGANIC SUBSTANCES.

a.—Nitrate of Potassa.
b.—Biborate of Soda.

B. REFRIGERANTS OPERATING ON THE SENSIBILITY OF THE BODY.

a.—Cool Air.
b.—Evaporating Lotions.
c.—Cold Water.
d.—Ice.

REFRIGERANTS WHICH OPERATE ON THE ORGANIC FUNCTIONS.

* ORGANIC VEGETABLE SUBSTANCES.

Vegetable Acids.—These are compounds of vegetable origin, that possess all the properties of an Acid. They can be separated from the plants which yield them; and are less liable

to spontaneous decomposition than other vegetable bodies. Like all organic matter, they undergo decomposition in a red heat. They are all compounds of either Carbon and Oxygen, or of Carbon, Hydrogen, and Oxygen.

The following are the officinal plants which yield those contained in the British Pharmacopœias, employed as Refrigerants.

WOOD-SORREL—Oxalis *acetosella*. L.—is an indigenous, elegant little plant, belonging to the natural order *Oxalidaceæ*.* It is found in woods and shady places, flowering in April and May. The root-stock, consisting of many scaly joints, is perennial, and throws up annual ternate leaves on slender purplish footstalks, with inversely cordate, bright green, hairy leaflets. The flowers are single, white, veined with purple, supported on radical peduncles. The herbaceous part of the plant is colourless: it has an agreeable acid taste, depending on Binoxalate of Potassa, which can be readily procured by evaporating the expressed juice of the leaves, redissolving the residue to separate the vegetable components with which the salt is united in the plant, and crystallizing. The quantity of the binoxalate obtained is somewhat less than one per cent. Wood-sorrel is now rarely used; although, boiled in milk, it furnishes a whey, which is a grateful refrigerant beverage in fevers.

COMMON SORREL, Rumex *Acetosa*, L. D. is an indigenous perennial, belonging to the natural order *Polygonaceæ*†, common in pastures and on banks, flowering in June. The roots are long, tapering, and woody; the stem erect, simple, striated, and leafy; the lower leaves stalked and arrow-shaped, the upper sessile, oblong, and narrow. The flowers are diœcious, in whorled clusters, with permanent tuberculated petals. The leaves are odourless, but have an agreeable, acid, subastringent taste, depending on the presence of Binoxalate of Potassa, with the Tartaric and Tannic Acids. The leaves which are officinal, were formerly used in the same manner and for the same purposes as the Wood-sorrel: but the facility of artificially preparing the *Oxalic Acid* and the *Binoxalate* has almost set aside the use of these plants.

The Oxalic Acid, the base of the binoxalate, exists in various states of combination in the rhizomes of Tormentil, Rhubarb, Florentine Iris, Ginger, Turmeric, and the bulb of Squill: in the barks of Simarouba, Cascarilla, and Canella *alba*; and in combination with soda in Salsola *Soda*, as well as in combination with Potassa in the Wood and the common Sorrel; and with lime in some Lichens. It may be procured by acting upon sugar, starch, gum, and almost every vegetable substance, with nitric

* Woodville's Med. Bot. p. 563. Richard, Hist. Nat. Med. t. ii, p. 721. Lindley, 222.

† Woodville's Medical Botany, third edition, p. 230. Richard, Hist. Nat. Med. t. ii, p. 504. Lindley, 360.

acid: a part of the acid is decomposed and converted into oxygen and deutoxide of nitrogen; whilst the sugar or vegetable matter is also decomposed, and carbonic acid, water, and oxalic acid, are formed. It is probable that, when sugar is employed, that substance is deprived of all its hydrogen and part of its carbon, which, uniting with the oxygen derived from the decomposed nitric acid, forms water and carbonic acid.

One hundred parts of sugar yield sixty of oxalic acid.

The crystals of oxalic acid, purified by repeated solution and crystallization, are slender, white, semitransparent, flattened, four-sided prisms, terminated by dihedral summits. They are intensely acid, and communicate a sensible acidity to 2633 parts of water. They slightly effloresce in dry air, dissolve in eleven times their weight of cold water, and without any limit in boiling water. The water of crystallization is expelled by heat, and the acid sublimes without decomposition. It is distinguished by forming with salts of lime a white precipitate, which is insoluble in an excess of the acid. Independent of the water of crystallization, which is equal to 1 equivalent, the constituents of this acid are—Carbon, 2 eq. = 12·24, + Oxygen 3 eq. = 24, equiv. 36·24; or, according to Berzelius, 33·78 of Carbon, + 66·22 of Oxygen, = 100·00.

The Oxalic Acid is not therapeutically employed in its uncombined state.

The Binoxalate is formed by adding the acid to Carbonate of Potassa; but it may be formed by exposing a mixture of 1 part of sugar and 4 parts of Potassa to a temperature of 400°, until the mixture fuses and swells up, then dissolving the mass in water, filtering and evaporating to obtain crystals. In this process the Carbon of the sugar derives its oxygen from the decomposition of the water, the hydrogen of which is evolved. The Potassa merely aids the decomposition. The Binoxalate crystallizes in small, rhombic prisms, which consist of 2 eq. Acid = 72·48, + 1 Potassa = 47.15, + 2 water = 18, equiv. 137·63. This salt, largely diluted with water and sweetened, may be used as a substitute for lemonade; but, as it possesses no advantage over that beverage, it is rarely employed.

Citric Acid. *Acidum Citricum.* L. E. D.—This acid is abundantly prepared by the hand of Nature in the fruit of the genus Citrus, Raspberry, Cranberry, in that of Tamarind, Gooseberries, Wortleberries, the Bird-cherry, Dulcamara berries, in Heps, and in several other acidulous fruits; but in all it is combined with malic acid, mucilage, and sugar. In the juice of the onion, it is found in combination with lime.

Before describing the acid in its separate state, it is proper to notice the officinal plants, the juice of the fruit of which is employed for making this acid, and therapeutically on account of its presence in it.

The Lemon-tree.—Citrus *Limonum.* L. E. D. *medica.* E. D. The Lemon-tree is a native of Asia; but it is now cultivated in many parts of Europe, more especially Spain and Portugal. It belongs to the natural order Aurantiaceæ*, and is readily recognized by its pale green, serrated, oblong, ovate leaves, supported on a winged stalk. The flowers are white within and purple without. The fruit is too well known to require description: the crypts on the rind are concave. The juice†, the part employed as a refrigerant, is of a straw colour, slightly turbid, and of an agreeable but intensely acid taste: its constituents are 1·77, Citric Acid, + 0·72 malic acid, sugar, gum, and bitter extractive, + 97·51 water, = 100·00‡. The gum and extractive render lemon juice very susceptible of decomposition. The juice of the lime (Citrus *medica*) is in every respect the same, both containing variable quantities of Citric Acid.

Lemon juice, when used as a refrigerant, is largely diluted with water, and moderately sweetened. The water for making lemonade should be boiling, and the sugar dissolved before the lemon juice is mixed with it. In febrile diseases, when cold drink is allowable, lemonade may be iced. Lemon juice is also employed to acidulate barley water, linseed tea, and other diluents. It is a more grateful agent than citric acid for making the common effervescing draught: f℥iiiss are sufficient to saturate ℈i of Bicarbonate of Potassa; f℥iv, ℈i of the Carbonate, and f℥vi, ℈i of sesquicarbonate of Ammonia. Lemon juice possesses refrigorant powers only when it is largely diluted.

A pleasant syrup is made by dissolving two pounds and a half of sugar in a pint of strained lemon juice, aided by a gentle heat; and, after twenty four hours rest, separating the clear syrup from the dregs§.

Citric Acid is prepared from lemon juice, according to the London Pharmacopœias, by adding to every pint ℥ix of prepared chalk, so as to form a citrate of lime, and then decomposing this with diluted sulphuric acid, aided by boiling. The insoluble sulphate of lime is separated by pressure through a linen cloth; and the citric acid obtained in crystals by the due evaporation of the fluid. Forty-nine parts of strong sulphuric acid, diluted with ten parts of water, are requisite to decompose eighty-six parts of citrate of lime. One hundred and sixty pounds of good lemon juice yield ℥x of pure crystallized acid. The Edinburgh College orders the lemon juice to be boiled, then allowed to rest to separate feculancies, and the clear liquor again boiled before the chalk is added‖.

Crystallized citric acid is colourless, inodorous, transparent,

* Woodville's Med. Bot. 3rd. ed. p 528. Richard, Hist. Nat. Med. vol. ii, p. 680. Lindley, 164.

† Succus, L. Lemons and Limes, E. Fructus succus, D. ‡ Prout.

§ Syrupus Limonum, L. E. Syrupus Limonis, D. Dose, one fluid drachm to four fluid drachms.

‖ Citric Acid was discovered by Scheele in 1784.

intensely but agreeably acid, soluble in its own weight of cold water at 60° Faht. and in half its weight of boiling water. It is also soluble in alcohol. The crystals are short rhomboidal prisms, terminated by a few trapezoidal faces. Their sp. gr. is 1·617*. By exposure to damp air, the crystals absorb moisture, and, when exposed to heat, they are decomposed before all the water of crystallization is driven off. The aqueous solution becomes mouldy by keeping. In its crystallized state, this acid consists of dry or anhydrous acid 76·32, + water 23·68, in 100 parts. The constituents of the anhydrous acid are—

				Berzelius.	Gay-Lussac.	Prout.
Carbon	4 eq.	(6·12 + 4)	= 24·48 or	41·309	33·801	34·28
Hydrogen	2 ——	(1 + 2)	= 2	3·800	6·330	4·75
Oxygen	4 ——	(8 + 4)	= 32	54·891	59·869	60·97
		Equiv.	58.48	100·000	100·000†	100·00

A solution of nine drachms of these crystals in f℥xii of distilled water equals in acidity recent lemon juice: gr. xvii of the crystals in solution saturate a scruple of carbonate of potassa; gr. xiv. ℈i of the Bicarbonate; and gr. xxiv a scruple of sesquicarbonate of ammonia.

Citric acid in solution is distinguished from tartaric acid by not rendering lime water turbid, unless it be in excess, and by forming soluble precipitates with salts of potassa. Its crystals, however, are often adulterated with those of tartaric acid, or sulphate of potassa: the first is detected by carefully saturating the solution with carbonate of potassa, and observing whether crystals of the bitartrate are formed; the second, by testing the solution with chloride of Calcium, which will form an insoluble Sulphate of Baryta, if the sulphate of potassa be present.

Citric acid is the best of the vegetable acids which are employed as refrigerants. The uncombined acid, however, is less grateful than the recent lemon juice; and fever patients are particularly sensible of this, when it is employed to saturate the carbonate of potassa, or of ammonia, in forming the common effervescing draught for checking vomiting. Largely diluted with water and slightly sweetened with sugar or syrup, it forms a useful and most agreeable drink in fevers, allaying heat and irritation, and reducing the pulse. In extemporaneous prescription, the Citric acid is incompatible with all the alkalies and their carbonates, magnesia, the salts of lime, and the earths and earthy carbonates, if its acid influence be required.

Citric acid is also the principle component of the juice of the orange and the pulp of the Tamarind.

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* The crystals differ in the amount of water of crystallization when formed at different temperatures: at 61° they contain 5 equivalents, at 212 only 3 equivalents. *Liebig.*

† Its composition is so near that of sugar as to lead to the supposition that it is transformed into sugar as the fruit containing it ripens.

The Orange, the fruit of Citrus *aurantium*. L. E. D. requires no description: except that the oil vesicles of the rind are elevated, instead of being depressed like that of the Lemon. The Orange is chiefly used as a desert fruit; but its juice is a valuable Refrigerant in febrile affections.

The *Tamarind*—the fruit of Tamarindus *Indica*. L. E. the T. *Indicus*, D.—a tree which is a native of the East and West Indies, belonging to the natural order Leguminosæ*, is a pendulous, slightly curved legume, somewhat compressed, with a hard, scabrous cortex, which never separate into valves, and covers three strong longitudinal fibres, one running down the upper, and the other two at equal distances down the inferior margin. The seeds are from six to twelve, nearly trapeziform, compressed, with a smooth, hard, tough shell, and embedded in a firm, acid pulp†. The fruit is imported in its natural state with the shell, and also preserved with sugar without the shell. The acidulous pulp lies between the cortex and endocarp, or membrane enclosing the seeds.

According to Vauquelin, the pulp of the Tamarind consists of 9·40 Citric acid, + 0·45 Malic acid, + 1·55 Tartaric acid, + 3·25 Bitartrate of Potassa, + 2·5 Sugar, + 4·7 Gum, + 6·25 Pectin, + 32·35 Parenchyma, + 37·55 Water, = 100.00‡. It is, when diluted with water, or combined with serum of milk, as whey, refrigerant, and at the same time gently aperient. Tamarind whey is made by boiling ℥ii of the preserved fruit in Oii of milk, and straining. It may be drank ad libitum.

Tartaric Acid. *Acidum Tartaricum*. L. E. D.—This acid is formed by the hand of Nature in some part of many plants—namely, the Pine Apple, Grape, Mulberries, Gooseberries, Tamarinds, the root of Dandelion, the bulb of Squill, some of the Fir tribe, the fruit of Rhus *typhinum*; in Pepper and in Chenopodium *vulvaria*; but it is seldom uncombined, being usually conjoined with potassa or with lime. The Tamarind, the Grape, and the Mulberry, are officinal.

The *Grape*—the fruit of the Vine, Vitis *vinifera*, L. E. D. —has been always regarded as cooling, and well calculated to allay thirst in inflammatory affections and in fever. They combine with their refrigerant, laxative and diuretic properties. The mucilaginous principle of the Grape resides chiefly in the vesicles of the central pulp; the saccharine matter in the intermediate substance between the central and cortical parts, and the acidulous juice in the cortex§; hence, in employing grapes

* Woodville's Med. Bot. third edition, p. 448, pl. 161. Richard, Hist. Nat. Med. t. ii, p. 727. Lindley, 266.

† The leaves are also subacid, but they are not officinal.

‡ Ann. de Chem. t. v. p. 92.

§ Fabbroni dell'Arte di fare il vino, Firenze, 1787, p. 17.

as a refrigerant and to allay thirst in fever, the skin should be well masticated before it is rejected: its cooling properties depending on the free Tartaric acid which it contains.

The *Mulberry-tree*—Morus *nigra*, L. D.—a native of Persia and China, but long since cultivated in this country, owes much of the excellence of its fruit to Tartaric acid. This tree, which belongs to the natural order Urticaceæ, is too well known to require description: its fruit is of a dark-violet colour, resembling an aggregation of berries*, succulant, of an agreeable odour, and its juice pleasantly acidulous. Its constituents are saccharine matter, Tartaric acid, and a violet-red colouring principle.

The juice of the Mulberry is refrigerant, and well adapted to allay thirst, moderate heat, and favour the perspiratory function in febrile affections; but, when too freely indulged in, it is apt to cause diarrhœa—a fact mentioned by Hippocrates†.

The London College orders a syrup, *Syrupus* Mori, to be made by dissolving two pounds and a half of sugar in a pint of the strained juice, with the assistance of heat. Owing to its acid, this Syrup cannot be prescribed with alkaline or earthy salts. It is of no value, except as a colouring agent.

Tartaric Acid is artificially prepared by decomposing the Bitartrate of Potassa with Chalk, so as to form a Tartrate of Lime, and next decomposing this Tartrate with Sulphuric acid, which, uniting with the lime and forming an insoluble salt, sets the acid free. In the formula of the London and Edinburgh Colleges, four pounds of Bitartrate of Potassa are ordered to be decomposed by twenty-five ounces and six drachms of prepared Chalk. The Dublin College orders ten parts of the Bitartrate and four parts of Chalk. Now the excess of acid in this quantity of Bitartrate only is neutralized by half the quantity of the chalk ordered: but the other half being converted into Chloride of Calcium by Hydrochloric acid, decomposes the neutral Tartarate of Potassa, and thus the whole of the acid of the Bitartrate is procured‡. Tartaric acid readily crystallizes in colourless, inodorous, semitransparent crystals, the primitive form of which is an oblique, right rhombic prism. The crystal of Tartaric acid is persistent in the air: soluble in five times its weight of water at 60°, and in twice its weight of boiling water. It is also sparingly soluble in alcohol. The watery solution has a very agreeable, acid taste, and reddens strongly the tincture of litmus; but it soon becomes mouldy. It is distinguished from all other acids by the solution forming a white precipitate when

* It is, botanically speaking, a *serrosis*. † *De victus ratione*, lib. ii, 360.

‡ This acid is not easily prepared in small quantity; but the preparation, which is made in large quantities for calico printers, is pure enough for medical use.

mixed with any salt of potassa; and from oxalic acid by the white precipitate which it forms with lime-water, dissolving readily in an excess of the acid: and also by not furnishing any precipitate with a solution of sulphate of lime.

Tartaric acid, in its crystallized state, is a compound of 88·16 of the anhydrous acid and 18·14 of water, in 100·00 parts. The constituents of the anhydrous acid are—

				Berzelius.	Gay-Lussac.	Prout.
Carbon	4 eq.	=	24·24 or	35.080	24·050	32·0
Oxygen	5	=	40	60·218	69·231	54·0
Hydrogen	2	=	2	3·807	6·629	4·0
Equivalent			66·24*	100·000	100·000	100·0

As it decomposes the alkaline carbonates and forms bitartrates, it cannot be prescribed in combination with them, unless we are desirous of forming tartrates and extricating the carbonic acid.

This acid, both in its free state, if largely diluted with water, and also in the state in which it is contained in the fruits above-mentioned, is a useful and agreeable Refrigerant. Tamarind tea is employed as ordinary beverage in febrile affections, especially those of a bilious kind; and its utility in nausea, vomiting, and even diarrhœa, is well established. It operates chiefly upon the cerebro-spinal system. The Bitartrate of Potassa, *Cream* of Tartar, is used in the same cases, in which its aperient property does not interfere.

Malic Acid.—This acid is most abundantly supplied by the hand of Nature in almost all the fleshy fruits; for example, those of the orders Pomaceæ, Amygdaleæ, and Myrtaceæ: Grapes, Currants†, Gooseberries, Strawberries, Elderberries, the fruit of the Mountain Ash tree, Sorbus *aucuparia*, and many other fruits, contain it. It forms, also, in combination with lime, a component in the juice of the Sempervivum *tectorum*, and several of the species of Sedum: and exists in Labdanum, and in Cocculus *Indicus*‡.

When obtained in a separate state, Malic acid is deliquescent, crystallizing with great difficulty; and, in its aqueous solution, it is decomposed by keeping. Its crystals are colourless, mammillary, pleasantly acid, and soluble both in water and alcohol. One hundred parts of the anhydrous acid consist of—

* Liebig's formula of the acid is C. 8, H. 4, O. 10, + 2 eq. It was discovered by Scheele in 1770.

† The red Currant contains 1·80 per cent. of Malic acid in combination with a trace of Citric acid, Sugar, Gum, and an animal matter.—Ann. de Chim. et de Phys. t. xvi, p. 259.

‡ Boullay, Journ de Pham. 1828, p. 63.

		Vauquelin.	Fromherz.	Leibig.	Prout.
Carbon	4 eq. = 24·48 or	38·3	29·357	41·238	40·68
Oxygen	4 — = 32	54·9	66·863	55·879	54·24
Hydrogen	2 — = 2	6·8	4·780	2·385	4·86
	Equiv. 58·48*	100·0	100·000	100·000	100·00

Malic acid is not employed as a remedy in its free state: in combination, it forms the refrigerant principles of many vegetable acidulous beverages employed in febrile affections.

b. Acetic Acid. *Acidum Aceticum.* L. E. D.—This acid is found in the sap of all plants, either in a free or in a combined state. It approaches nearer than any other of the vegetable acids to the state of the primary vegetable products; namely, gum, fecula, sugar, and ligneous matter, all of which, by a small modification of their components, form Acetic Acid. This analogy, more or less complete, as De Candolle has well remarked, tends on the one hand to explain the facility of its formation, and perhaps, on the other, to demonstrate that acidification is a phenomenon different from that of oxygenation as manifested in the formation of the mineral acids†.

Acetic acid is prepared for medicinal use by submitting vegetable matter to destructive distillation, or by subjecting it to fermentation. In the former process, it is procured by distilling wood in large cast-iron cylinders. It comes over mixed with *tar* and volatile oil; in which state it is combined with Chalk to form an Acetate, which is afterwards decomposed by Sulphate of Soda, and converted into Acetate of Soda, which is again decomposed by Sulphuric acid, and Acetic acid and Sulphate of Soda are procured. The acid in this state is termed pyroligneous acid; it possesses all the properties of pure Acetic acid.

Common Vinegar is prepared by the acetous fermentation of wine, or infusion of malt, or sugar and water, or any substance containing much saccharine matter. When saccharine matters are employed, weak alcohol is first formed, and, by exposing that to the air at a temperature of 80°, Oxygen is absorbed; and by removing half the hydrogen, the alcohol passes into Acetic acid. Two equivalents of Alcohol are thus converted into one equivalent of Acetic acid, by the formation of three equivalents of water‡. In this crude state, it is more or less coloured, and

* Liebig's formula is C. 8, H. 4, O. 8, + 2 H. O.

† Physiologie Végétale, par A. P. De Candolle, t. i, p. 312.

‡ This theory is supported by the formation of Acetic acid from Alcohol, by spongy platinum. "Dishes of earthenware are placed on shelves in a close case; and into each a quantity of alcohol being poured, a portion of spongy platinum, moistened, is suspended over it; and, at the same time, the evaporation of the spirit is favoured by hanging several leaves of porous paper in the case, with their lower edges dipped in the spirit. The anhydrous alcohol is thus oxidized, and converted into Acetic acid, which condenses in the case and trickles down in streams to the bottom.

contains mucilage and gluten. The Vinegar sold in the shops contains also a small proportion of Sulphuric acid, the law permitting the maker to mix with it a thousandth of its weight of that acid. To free Vinegar from impurities, it is distilled in glass vessels: the first eighth part which passes over is rejected; the six parts which follow constitute the *Distilled Vinegar* of the Pharmacopœias. This is a colourless, limpid, volatile, slightly pungent fluid, intensely sour, and having a refreshing odour, and containing five per cent. of Acetic acid. Sixteen parts of pure Pyroligneous acid, of a gravity of 1·046, mixed with eighty-four of water, form an acid of a similar strength and quality. Distilled vinegar is sometimes adulterated with Sulphuric or with Hydrochloric acid: the presence of the first is detected by Chloride of Barium; that of the second by Nitrate of Silver. It may also contain salts of copper, tin, or lead: the copper is detected by Ferrocyanate of Potassa or by Ammonia; the tin by Nitro-chloride of Gold; and the lead by Sulphuretted-hydrogen.

The pure anhydrous Acetic acid, contained in common and in distilled vinegar, consists of—

			Berzelius.	Prout*.	Gay-Lussac.
4 eq. of Carbon	$(6{\cdot}12 \times 4) =$	24·48	or 46·83	47·05	50·221
3 —— Hydrogen	$(1 \times 3) =$	3	6·35	6·87	5·629
3 —— Oxygen	$(8 \times 3) =$	24	46·82	47·08	44·147
	Equiv.	51·48	100·00	100·00	100·00

Its vapour is inflammable, and burns with a pale-blue flame, forming water and carbonic acid. Acetic acid readily combines with bases, and forms with them a distinct class of salts.

The quantity of water contained in any specimen is denoted by the specific gravity of the fluid; that of the distilled vinegar of the Pharmacopœias is 1·0036.

For administration as a Refrigerant beverage, Vinegar, or Acetic acid, is largely diluted with water or any vegetable demulcent fluid; but, owing to the more agreeable qualities of the other vegetable acids, this acid is seldom medicinally administered. When taken, properly diluted, in a febrile state of the habit, the pulse falls, the animal temperature is lowered, and the secretions are improved. In hæmorrhages, the cold feeling, which a mix-

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The action is manifested by an increase of temperature. In this way, 1090 cubic inches of air can oxidize 110 of anhydrous alcohol, converting these into 122 grains of pure Acetic acid and $64\frac{1}{2}$ grains of water. When the oxygen of the enclosed air is consumed, the process may be renewed by opening the case a little to admit fresh air.

"With from 7 to 8 ounces of the Platinum powder, in a box of 12 cubic feet capacity, one pound of Alcohol may be thus converted in a day into pure Acetic acid. The platinum powder does not waste, nor become deteriorated by the process"—Daniel's Introduction to Chem Phil. p. 391.

* Dr. Prout states that the oxygen and hydrogen of this acid are in the exact proportions to form water. Phil. Trans. 1827, p. 355.

ture of it with water produces on the skin, is sympathetically extended to the rest of the body. I have been in the habit of ordering it, as an internal refrigerant, in the hectic fever of Phthisis, with advantage, in doses of a fluid drachm diluted with some demulcent, three or four times a day. It should be recollected that, if opium be prescribed in conjunction with it, the activity of the narcotic is greatly augmented by such a combination. When largely diluted, its external application as a refrigerant lotion is applicable to every case in which the skin is preternaturally hot, if no peculiar idiosyncracy forbids its employment.

** INORGANIC SUBSTANCES OPERATING AS REFRIGERANTS.

NITRATE OF POTASSA. *Potassæ Nitras.* L. E. D.—This salt is the spontaneous production of Nature in many parts of the world. In the organized kingdom, it exists in the roots of Pariera *Brava*, and Geum *Urbanum*, the rhizomes or tubers of Ginger. In the inorganic kingdom it is most abundant. It is found crystallized on the surface of the soil in Spain, and in Egypt, India, especially in the province of Tishût, in Bengal, South America, Africa. It is also found in great abundance in the Pulo de Molfetta—a deep cavity formed by the falling in of several caverns in the province of Puglia, in Naples: it is procured by the lixiviation of the common soil near the city of Klemsan, in the kingdom of Algiers; and in a cave near Mensoora, in Ceylon, there is a very rich impregnation of nitre*. In the north of Europe, in Germany, it is obtained from artificial composts, consisting of vegetable and animal substances mixed with calcareous earth, formed into beds, sometimes into walls, over which roofs are raised to protect them from the weather. In France, nitre beds (Nitrieres) are also formed from the lime and plaster of old buildings, which have been inhabited by man and other animals. These plasters are reduced to powder, after having been for years exposed to the air, and mixed up with offal and decayed leaves; this powder is then lixiviated, and the fluid evaporated. Sulphate of Potassa is in the mean time added, to decompose the calcareous salts, which are thus deposited in an insoluble state, leaving the nitre in solution. By repeated separations and evaporations, the Nitrate of Potassa is thus procured in its crystalline form. The same plan is adopted in Sweden, and in Prussia; walls instead of beds are used.

* Davy's Account of the Interior of Ceylon. The νἱτρον of Herodotus and Theophrastus, and the nitrum of Pliny, were not Nitrate of Potassa, but the Natron of the Egyptian lakes, an impure Carbonate of Soda. Theophrastus mentions that it is produced from oak ashes, which at once points out the alkaline nature of the *Nitrum*

The theory of the formation of Nitre, in these artificial beds, was first clearly pointed out by Mr. Cavendish. The animal and vegetable matters mixed up with the calcareous earth consist of nitrogen, hydrogen, oxygen, and carbon, which principles are evolved during their decomposition, and, reuniting by the operation of new affinities, produce new compounds, among which we find nitric acid, which is formed by the union of the Nitrogen from the decomposition of the animal matter, with the Oxygen from that of the vegetable. This accounts for the acid; but how the alkali is formed, or what part the calcareous matter plays in its formation, in these artificial compounds, is still unknown.

The greater part of the nitrate of potassa used in this country is procured from impure nitre, imported from Bengal, the production of the soil. It is of very different degrees of purity, chiefly lixiviated and crystallized. It generally contains from 45 to 70 per cent. of pure Nitrate of Potassa. When brought to this country, it is dissolved in water, and boiled until a pellicle form on the surface of the liquid, after which it is poured into leaden coolers, in which it crystallizes.

Nitrate of Potassa, when pure, is in six-sided prisms*. It is white, semipellucid, and brittle, inodorous, and has a bitterish, sharp taste, occasioning a sensation of cold both in the mouth and the stomach. The crystals of nitre are not altered by exposure to the air: they contain water, mechanically lodged within them: dissolved in five times their weight of water, at 60° Faht. and their own weight of boiling water, cold is generated during the solution. They are insoluble in strong alcohol. At 616° Faht. Nitrate of Potassa melts, and, on cooling, concretes into a compact mass; which, run into moulds, is called Sal Prunelle. In a high temperature, it is decomposed, and gives out about one third of its weight of pure oxygen. When Nitrate of Potassa is mixed with charcoal, and thrown into a red-hot crucible, it deflagrates; and a pure *Carbonate of Potassa* is the result. When Sulphuric acid is mixed with Nitre, and heat applied, Nitric acid is evolved. Nitrate of Potassa consists of 1 eq. of Nitric Acid $= 54{\cdot}15, + 1$ of Potassa $= 47{\cdot}15$; equiv. $101{\cdot}30$: or, of Nitric Acid $52, +$ Potassa $48, = 100$.

Nitrate of Potassa operates either as a sedative or a refrigerant, or as an excitant, according as it is taken in small or in large doses; or according to the mode of administering it. In

of the Greeks. The *Nether* of sacred writ (Prov. xxv, v. 20) effervesced with vinegar, and, therefore, could not be nitre. It is probable that Nitre was first known in India.

* It has very remarkable optical properties. Trans. of the Royal Society, Edin. 1814.

moderate doses of fifteen grains to a scruple, it produces a powerful sympathetic effect on the nervous system, diminishing the action of the pulse in strength and frequency, and lowering the animal heat: the skin becomes pale, and the person experiences a feeling of languor. Even in larger doses, namely, two scruples to a drachm, as ascertained by Dr. Alexander, in experiments upon himself*, it produces a refrigerant effect; but this is soon followed by reaction. In doses of from six drachms to an ounce, it causes symptoms of gastritis, with vertigo, tremors, failure of pulse, cold sweats, and insensibility, which have terminated in death. Post-mortem examinations have displayed evidences of acute inflammation of the villous coat of the stomach. To obtain the refrigerant effect of Nitrate of Potassa, therefore, the salt must be administered in moderate doses; namely, from fifteen grains to half a drachm, repeated at short intervals. It owes its refrigerant quality partly to its chemical property of converting sensible into insensible caloric during its solution, hence abstracting it from the stomach; and by sympathy affecting the frame. The best mode of administering the salt as a refrigerant, is in doses of fifteen grains, mixed with sugar; and the powder should not be dissolved until the instant in which it is to be swallowed. When the coldness thus produced in the stomach causes uneasiness or spasm, the use of the salt should be discontinued.

Biborate of Soda. *Borax*. L. E. D.—This salt is a compound of Boracic acid and Soda, largely prepared by the hand of Nature. It exists in some mineral springs; and in Thibet and Persia it is deposited in lakes, from which it is collected and brought to Europe, under the name of *Tincal*†. In this state, it is in six-sided flattened prisms, frequently mixed with sand and fat, to prevent it from efflorescing. When it is purified, it crystallizes in irregular masses.

Biborate of soda is now chiefly prepared by saturating with Carbonate of soda the Boracic acid, procured from the vapour, which, issuing from the interior of the earth, is condensed in the cold water, through which it is made to pass in the lagoons of Castel-Nuovo, and Cherchiago. By evaporation, the Boracid acid is procured in crystals, a large quantity being held in solution in the vapour‡. The acid, thus procured, is nearly pure: it is added to a solution of Carbonate of soda in a boiling state, which it decomposes and unites with the soda, expelling

* Experimental Essays, p. 113, et seq.

† According to Professor Royle, the name is derived from *tincana*, the Sanscrit name for Borax. Essay on Hindoo Med. p. 97.

‡ It was formerly prepared in the same manner with acid procured from the waters of Sasso. Boracic acid in the anhydrous state is a compound of 29·41 of Boron, + 70·59 of Oxygen, = 100·00; or, 1 eq. of Boron, = 20, + 6 eq. of Oxygen, = 48, making the equivalent = 68 (Bor. + 6 O.).

the Carbonic acid in a gaseous form; and when the solution is saturated, the Biborate is crystallized.

The Dutch were the great purifiers of *Tincal* or crude Borax; and such is the force of prejudice, that, on the Continent, the artificial salt prepared with the above-mentioned acid is obliged to be sent to Holland, and re-exported as Dutch borax.

Borax, or Biborate of Soda, is semi-transparent; and crystallizes in large, colourless, flattened, hexahedral prisms. It is slightly efflorescent, is inodorous, and has a styptic, cool, somewhat alkalescent taste, and an alkaline reaction, whence the incorrect name, Subborate, originated. It is soluble in twenty parts of cold, and in six of boiling water. Exposed to heat, it loses its water of crystallization, swells up like alum, and becomes a dry, white, spongy mass, without suffering decomposition: it is then called *Calcined Borax*. In a strong heat, it becomes anhydrous, and is vitrified. The crystallized salt consists of—

Boracic Acid . .	34 or 2 eq.	(68×2)	=	136
Soda	17 — 1 eq.	———	=	31·3
Water	49 — 8 eq.	(9×8)	=	72
	100	Equivalent	=	239·3

100 parts of the dry salt contain of Boracic acid 70, + Soda 30 parts. The alkaline salts of Boracic acid are easily distinguished from all others, by digesting them in strong sulphuric acid, evaporating to dryness, and boiling the residue in alcohol. This solution burns with a green flame. Biborate of Soda also strikes a rose-red colour with Chloride of Gold, and a blue with solution of Cobalt. It is decomposed by all the mineral acids, and the Boracic acid is set free in the form of small crystalline scales: these acids, therefore, and also Chloride of Barium and of Lime, Protonitrate of Mercury and Nitrate of Silver, which decompose it, are incompatible with Borax. It exerts a peculiar action on Bitartrate of Potassa, and on Honey, which I may take this opportunity of noticing. If six parts of Bitartrate of Potassa, two parts of Biborate of Soda, and six parts of water, be boiled together for five minutes, allowed to cool, and filtered to separate some Tartrate of Lime which is always contained in Bitartrate of Potassa, and the solution be then evaporated to dryness, we obtain a deliquescent salt. This salt has been termed Soluble Cream of Tartar by the French chemists. A chemical union is also effected, when Biborate of Soda is mixed with a solution of Honey and water, or with equal parts of Honey, and a deliquescent salt is formed with properties altogether new. It is on this salt, therefore, not on the Borax, that the efficacy of the mixture of Honey and Borax, in aphthous affections, depends—a fact

which explains the anomaly, that powdered Borax, or its solution in water, applied to aphthæ, does not produce the same beneficial effect as the Honey of Borax, *Mel Boracis*, L. E. D*.

Biborate of Soda is seldom prescribed as a general refrigerant in this country: but, on the Continent, both this salt and Boracic acid, under the name of Sal Sedativum, is employed in inflammatory febrile affections. As a topical application, it is sometimes mixed with sugar, and the powder sprinkled on apthous surfaces; or it is applied in its combination with Honey. The dose as a refrigerant is ʒss to ʒi.

B. REFRIGERANTS ACTING ON THE SENSIBILITY OF THE BODY.

a. COOL AIR.—The agreeable feeling produced by cool air would lead naturally to its application in a heated state of the body; and might have early suggested to practitioners of the healing art the propriety of employing it as a remedial agent in fever. But such is the perversion of human beings, that the older physicians at one time opposed this instinctive desire for cool air in fever patients, and subjected them equally to the hazard and the torture of a hot regimen. In modern practice, the admission of cool air to the apartments of the sick, in all acute diseases, especially in fever, is fully acknowledged: and nothing is found so soon to change the character of the disease, and to produce a favourable crisis. It is, however, of great importance to distinguish between exposure to cool and cold air, especially in convalescence from fever. The one is a grateful refrigerant, the other depresses the weak to an alarming degree.

b. REFRIGERANT LOTIONS.—These are mixtures of water and Spirit of wine, or Ether, or Acetic acid, or liquor Ammoniæ, or Acetates; the intention of these additions to the water being merely to facilitate the evaporation of that liquid. For the same reason, also, they should be applied with a single layer of linen or muslin; as the thinner the medium is, the more rapid the evaporation. When they are to be applied, the scalp should be shaved: but the lotion should not be applied until two hours after that operation.

c. COLD WATER.—If cool air be serviceable in fever, cold water is equally so, and its application is more extensive.

d. ICE operates exactly in the same manner as cool air and cold water, namely, by abstracting caloric from the system. It should be pounded and put into a bladder, or a Macintosh, cool cap, in such quantity only as will enable this receptacle to be

* Honey of Borax is made by mixing together one drachm of Biborate of Soda and one ounce of clarified Honey.

applied to the shaven scalp. In its application, attention should be paid to get the head to lie on the ice bag, so as to keep that part cool, which cannot be influenced by evaporating lotions.

THERAPEUTICAL EMPLOYMENT OF REFRIGERANTS.

The name of this class of remedies points out the nature of the diseases in which they are indicated; namely, all those attended with a morbid elevation of temperature, or, in other words, attended with febrile symptoms. Refrigerants are not, however, to be relied upon as remedial agents, but merely as adjuncts to more active means; with the exception of cold, the influence of which shall be shortly examined.

In continued *Fevers*, the vegetable acids, in the fruits which contain them, are well calculated to quench thirst, and assist in allaying the morbid heat of the surface; but, if immoderately taken, they are apt to purge; in which case, the saline refrigerants, namely, the common effervescing draught, and Nitrate of Potassa, are preferable: indeed, in fevers of a typhoid character, the Nitrate of Potassa operates not only as a refrigerant, but as an alterative, exerting its influence in altering the condition of the blood, which undergoes a decided change in continued fevers, especially those of a malignant kind. In *Remittent fever*, cooling, acidulated drinks tend greatly to diminish excitement; but in infantile remittents, the Nitrate of Potassa is to be preferred to the vegetable acids, on account of the irritable condition of the mucous membrane, which always accompanies that form of fever. The advantages of refrigerants, and of the general cooling and antiphlogistic treatment in *Miliary fever*, have been often and fully demonstrated: one of the most distressing symptoms is thirst, which is best abated by subacid drinks.

In the treatment of the *Eruptive fevers* (Exanthemata), the employment of Refrigerants cannot be dispensed with; and whatever may be the character of the eruption, if much fever be present, nothing tends more to allay the excitement, moderate the morbid elevation of temperature, and carry the patient safely through the disease, than the frequent administration of cooling diluent fluids of a subacidulous kind: and to these, the Nitrate of Potassa, in small doses, added at the moment of taking the fluids, is a valuable adjunct. Indeed, in simple Scarlatina, little else is necessary than to keep the patient in bed, to preserve the apartment cool, and to prescribe cooling acidulous drinks, with abstinence from animal food and stimulants of every description. When the disease assumes a typhoid or malignant character, and the remark applies equally to confluent Small-pox, and to Erysipelas, these beverages do not interfere with the means requisite for supporting the strength of the patient.

In *Pneumonia*, the diluted vegetable acids are not only

useful as Refrigerants, but they are grateful to the stomach, and often form excellent vehicles for more active remedies, except when these are of an antimonial kind; in which case, the vegetable acids are apt to cause vomiting. It might be supposed that the same advantages are likely to be obtained from them in Bronchitis; but my observations have led to a conviction that they augment the cough, and increase the acrimony of the sputa: on the other hand, simple demulcents, with small doses of Nitrate of Potassa, after either moderate, general, or topical bleeding, prove almost invariably beneficial. Indeed, with the exceptions that have been stated, the acidulous Refrigerants may be advantageously prescribed in every disease connected with vascular excitement and augmented heat of the surface.

The powerful influence of the vegetable acids, especially as they exist in the fruits which yield them, in *scorbutus*, sea-scurvy, cannot be ascribed to their refrigerant properties; although it is worthy of remark, that, next to these acids, nothing has proved more beneficial in this loathsome disease than the Nitrate of Potassa, which is said even to augment the antiscorbutic properties of the juice of the orange and the lemon. This is not the place to investigate the causes of the efficiency of this acid in Scorbutus; I shall, therefore, merely remark that the long continuance of their employment is supposed to give a tendency to the deposition of tubercles in the lungs.

The Refrigerants which operate on the sensibility of the body are few; but they are more directly cooling agents than those which operate merely through the medium of the stomach. They consist of *diluted Acetic Acid*, and *Cold*, in its various forms of *Cold Air*, *Cold Water*, *Ice*, and *Evaporating Lotions*.

When cold is applied to the surface, the effect is an immediate abstraction of caloric from the part, and a diminution of sensibility; and the extension of this effect, by sympathy, to the rest of the system: hence, this powerful agent is not to be regarded as a local, but as a general remedy; and in cases of augmented temperature, with some exceptions, it may be employed in every instance attended with a hot, dry skin, and a quick, hard, or tense pulse. Perhaps much of the beneficial effect obtained even from local Refrigerants is to be attributed to diminished vascular action. Under every circumstance, the temperature of the patient should be previously accurately ascertained by the assistance of the thermometer; and the cooling agent should be abont fifteen degrees below the temperature of the body.

There are various modes of using cold as a topical Refrigerant:—it may be used under the form of Evaporating Lotions already noticed, Sponging with the diluted Acetic Acid, Cool Air, the Cold Affusion, and Cold Sponging.

a. Sponging with diluted Acetic Acid.—On the principles which have been stated, as regulating the operation of Refri-

gerants in any form, Acetic Acid, or Vinegar, largely diluted with water, applied to the surface, diminishes morbid heat, and allays pain; whilst the cold sensation which it produces is extended over the whole body by nervous sympathy. As a therapeutical agent, it has been advantageously employed in hæmorrhagic affections, more especially those connected with the uterus; in which it is applied to the thighs and the abdomen. In cases of fever, and in inflammation of internal organs, when circumstances occur to prevent the application of cold water to the skin, vinegar and water may be used either cool, that is, at a temperature between 50° and 60° Faht., or in a tepid state, at a temperature of from 87° to 97° Faht. When applied in the former state, very little more advantage is probably derived from the addition of the vinegar to the water, than the increased evaporation it induces; as the low degree of temperature of the fluid is the efficient cause of the advantage which is obtained from the application: but when the tepid sponging with vinegar and water is employed, something is also due to the impression made on the nerves of the skin by the Acetic Acid. The sensibility is diminished, whilst the heart is rapidly abated, without that shock to the feelings of the patient which the cold affusion produces. Sponging with vinegar and water, in fevers, may be resorted to whenever the skin is decidedly hotter than natural. It is extremely grateful to the patient, relieving the morbid heat, whether general, or only partial in the palms of the hands and the soles of the feet; reducing the pulse and tranquillizing the system, without inducing fatigue. As it is sometimes necessary to consult the feelings of patients, we find that the tepid sponging with vinegar and water is more agreeable than cold sponging. It is well adapted for feeble habits when the heart is not much above the natural standard; and it is applicable to every case of fever where the excitement is moderate; but its effects are less permanent than those of the cold affusions.

b. Cool air.—The sedative operation of cold, as a therapeutical agent, is most striking when *Cool Air, Cold Water*, or *Ice*, are the media for abstracting caloric from the body labouring under fever, or any acute disease accompanied with much heat of surface. To those who are little accustomed to observe the effects of fever among the lower classes of society, where prejudice opposes free ventilation, and cleanliness is not one of the domestic virtues, the salutary influence of *cool air* admitted into the apartments of the sick can scarcely be appreciated. I have seen a fever assuming the most unfavourable aspect, the patient having a dry parched tongue, with extreme restlessness, tossing of the arms and uncovering the body, whilst tympanitic distension of the abdomen was beginning to appear, yet, changed in its whole complexion, in a few hours, by the free exposure of the patient to cool air. Indeed, it is of the first importance, in every case of

fever, to ventilate the sick room, and especially to replace the heated and foul air deteriorated by the emanations from the body of the sick, with cool, pure air. Independent, however, of the purity of the air, the simple abstraction of caloric from the body, within certain limits, is a salutary process. According to the degree with which caloric is abstracted, cold operates as a therapeutical agent, either by depressing inordinate action of the sanguiferous system, or bestowing vigour on the body. It is the first of these, its *sedative* or *refrigerant* influence, which at present concerns us.

The beneficial influence of cold, in inflammation and in fevers, is not, however, solely due to the simple diminution of heat which it effects, but, in a great measure, to its power of allaying increased vascular action. When the inflammation is local, various means, which shall be afterwards noticed, are employed; but when a degree of morbid heat is general over the system, as in fever, then the whole surface must be brought under the influence of the cooling agent, which, in this case, must be either air or water. Both are generally employed.

To understand correctly the mode in which Cold operates as a therapeutical agent, it is necessary to look a little to its *morbid influence*, when it is applied in an intense degree. The first effect of exposure of the body to intense cold, or a considerable abstraction of caloric from it, besides the well-known sensation of cold, is pallor of the skin, from the diminished capacity of the capillary vessels, and the consequent absence of blood in them; a livid hue of the hands, ears, nose, and lips, owing to the stagnation of blood within the minute cutaneous vessels, and its becoming, as it were, venous; general shrinking of the skin, so that the small glands, that are embedded in it, seem to rise and give the surface the appearance of goose-skin. But the influence of the cold soon extends beyond the surface, the fingers and toes become sensibly smaller, so that rings fall off, and the action of the heart becomes diminished, both in force and in frequency: sometimes the opposite effect takes place,—the pulse, although much weakened, becoming quicker than natural. These symptoms vary in different persons exposed to the same degree of cold: it is only when cold affords a grateful feeling, whether in health or in disease, that it proves salutary. When the cold is more intense than that requisite to produce those symptoms which have been just described, it depresses the powers of life to an alarming degree; and the influence of this low temperature, extending beyond the vascular system, attacks the brain and nerves; numbness is the consequence, and occasionally the sensibility is so much depressed, that a pin, or any small body, cannot be felt when placed between the ends of any two fingers. The motions of the hand are then regulated, not by the touch, but by sight, owing probably to the defective supply of blood to the extreme nerves, diminishing their energy. Not only the

sense of touch, and the sensibility of the entire surface, is lowered, but some of the other senses, especially that of taste, are also diminished in acuteness: the brain itself loses its energy, and there is an irresistible desire to sleep. Many striking illustrations of this influence of cold are on record. I shall mention only one, which was displayed on the late Dr. Clarke, Professor of Mineralogy in the University of Cambridge. He was returning home, after having performed divine service in a church near Cambridge, in the afternoon of a cold, snowy Sunday, in the year 1829; when finding that he became very sleepy, and knowing well the danger of giving way to sleep, he put his horse to a full trot, hoping by this means to rouse himself from the alarming torpor which was coming over him: it was unavailing; and then, fearing that he would fall from his seat, he dismounted; and, being determined to use every effort to resist sleep, put the bridle under his arm and walked onwards as rapidly as he was able. This, however, did not long succeed; the bridle dropped from his arm, his limbs began to fail, and he was in the act of sinking down in the snow, when a person whom he knew came up in a gig, and carried him home.

These effects are sufficient to demonstrate the powerful *sedative* influence of cold; and it is as much on account of this, as of its *refrigerant* influence, that, in moderation, it becomes a valuable therapeutical agent.

c. Cold Affusion—Cold Sponging.—The Cold Affusion implies dashing cold water over the body of the patient, who is stripped naked, until rigors are felt. The temperature of the water should depend on the season of the year, and many other circumstances; and it may be employed either with or without saline impregnations. In determining upon the propriety of using the Cold Affusion, we must be guided both by the condition of the patient and by our knowledge of the influence of the remedy. The sooner the Cold Affusion is resorted to after the rigors of the first stage of fever have abated, the better; but the safest guide is, to take the temperature of the body at its height. We must, however, recollect that, even when the thermometer indicates a high morbid temperature, the Cold Affusion should not be used, if the patient feel much chilliness; nor should it be had recourse to, if the temperature be less than that which may be considered healthful.

When *Cold Sponging* is to be employed, after ascertaining the temperature of the body, by a thermometer placed under the tongue with the lips closed, or in the axilla, the patient is to be taken out of bed, and two or three attendants, with large wet sponges, should pass them over the different parts of the naked body in succession, until a chill comes over the patient, who is then to be wiped dry and placed in bed, and moderately covered.

If the *Cold Affusion* be employed, the patient, stripped

naked, should be seated in an empty tub, and from three to five or six gallons of water, at the temperature of 40° to 60° Faht. poured on his head and body, and repeated until a chill or rigor is produced. The time that the Cold Affusion may be continued depends on circumstances; but, in general, it occupies from two to fifteen minutes. After using it, the patient should be wiped dry, and some warm wine and water administered when he is put to bed. The intention of this form of applying cold, as well as cold sponging, is to diminish the morbid heat of the skin, to lower the pulse, and to induce perspiration and sleep. The effects depend partly on the temperature of the water, partly on the shock given to the system by the sudden mode of applying it, and the mechanical impulse on the surface.

The safest and most advantageous time for using the Cold Affusion is during the height of the febrile exacerbation. This occurs, in continued fevers, generally in the evening: but it may be used at any time that the temperature of the body demands it.

During the hot stage of *Intermittents*, when the surface is dry and parched, and the general heat greatly augmented, cold in every form applied to the surface, and cold fluids taken into the stomach, are not only grateful to the patient, but of the utmost value, lessening the force and the frequency of the pulse, cooling the burning heat of the skin, and bringing on the sweating stage. Its use, however, requires some degree of caution; but when it has been begun, it should be continued until the heat is reduced to the natural standard. After this is effected, and the sweating stage has been induced, then the application of cold is no longer proper; as it abstracts the heat too rapidly, inducing urgent sickness and debility.

In *Remittent fevers*, the application of cold, and the administration of cold drinks, are to be regulated by the same rules as in Intermittents; but the local application of ice or cold water to the scalp is more likely to be required, and to demand attention.

In *Continued fevers*, cold is advantageously employed in every form. The dieta aquea of the Italians is a relic of the cold drink of the ancients, which was pushed very far in Continued fevers; and certainly no practice could be more judicious. But, if the fears of the friends of the patient do not oppose the use of the Cold Affusion, this method of employing cold in *Continued fever* is the most beneficial. Next to it is the Cool Affusion, and equal to that is Cold Sponging.

Dr. Currie, who paid much attention to this subject, points out the cautions which should be observed in the use of the cold affusion; and lays down the following rules as necessary to be attended to in employing the cold affusion.

1. It should not be used during the cold stage of a febrile paroxysm: for, in that case, the respiration is nearly suspended,

the pulse becomes feeble and fluttering, and of incalculable frequency; the extremities become doubly cold and shrivelled, and the patient seems to struggle with the pangs of immediate dissolution. Indeed, under such circumstances, the repeated affusion of a few buckets of cold water would extinguish life.

2. The Cold Affusion ought never to be employed when the thermometer indicates a degree of temperature less than, or equal to, the natural heat of the body, although the patient express no feeling of chilliness; a circumstance which sometimes occurs in the last stages of fever, when the powers of life are depressed.

3. It is also necessary to abstain from the use of the Cold Affusion when the body is bathed in perspiration: and when the patient feels chilly, although the thermometer indicates a morbid excess of heat.

With regard to the period of fever in which the application of the cold affusion is useful, some distinct rules are also necessary.

1. In that state of Continued fever, when there is no obvious apyrexia, the Cold Affusion is especially indicated; and the more early it is employed, when this state shews itself, the better. Dr. Curry found that when used early, within the first three days of the fever, the complete formation of the disease was prevented; and this may even be expected on the fifth day, but not later.

2. If the fever be more advanced, the debility is generally too great to permit the system to bear the sedative influence of the Cold Affusion; hence the warm or tepid affusion must be substituted for it: but, nevertheless, if the symptoms indicating its use present themselves, there is no reason why it may not be employed at any period of the disease. One circumstance strongly against the employment of the affusion, in the advanced stages of fever, is the syncope which generally occurs when the patient is raised into the erect position.

Such are the precautions requisite in the employment of the *Cold Affusion;* when it is used early, namely, on the first or second day of a fever, its progress is often checked; but this is seldom the case, if its application be delayed until the fourth or fifth day; although it moderates the symptoms and proves useful when used even so late as the eighth or tenth day. In this advanced period of the fever, however, the water should never be more than 15 or 20 degrees under the usual heat of the body. Perhaps it is preferable, in such circumstances, to adopt the cold sponging in preference to the cold affusion.

Notwithstanding these advantages of the Cold Affusion, it is not much employed in this country, owing to the difficulty of persuading patients, in private practice, to submit to it: and it must be acknowledged that, although it undoubtedly mitigates greatly the symptoms of fever, yet it rarely cuts short a fever; hence, although the cold sponging is less powerful, and its

effects are less permanent, yet it has been preferred to the cold affusion. As a means of relieving morbid heat, reducing the pulse, and tranquillizing the system, it is undoubtedly less efficacious than the Cold Affusion.

The *Cool Affusion* may be substituted for the *Cold*, when the patient is weak and irritable, and the temperature of the body not very ardent. The water for this purpose should not exceed 85° Faht. It is seldom employed; and when the Cold Affusion cannot be used, it is more common to substitute tepid and warm sponging. Dr. Currie regarded it a good precursor of the Cold Affusion.

The Cold Affusion is best adapted for inflammatory fevers; and more especially those of warm climates, which are usually accompanied with more ardent heat than those of temperate countries. Even in this form of fever, care should be taken to ascertain that there is no visceral inflammation present; as much hazard might, in that case, arise from so powerful a shock given to the system. It has been successfully employed in both Continued and Intermittent fevers. In the former, the effect has occasionally been immediate and the fever cut short. The cold affusion in such cases is followed by sleep, and profuse perspiration.

In active hæmorrhages, the sedative influence of cold is undoubted. The method of applying it varies according to the nature of the hæmorrhage. Thus, in epistaxis, the face and head may be immersed in cold water; but frequently the sympathetic influence of cold, applied between the shoulders, is more rapidly useful: it is to this *sympathetic* influence, also, that dashing cold water on the genitals has sometimes almost instantaneously suppressed bleeding from the nostrils: hence the popular custom of putting a cold key down the back. In *hæmoptysis*, or bleeding from the lungs, spitting of blood as it is termed, a disease which generally arises from congestion in the lungs, produced by a variety of causes, always formidable, and too often associated with phthisis, cold has a powerful influence. The patient should be placed nearly erect in bed, and the chest exposed to the free influence of *cold air*, whilst ice should be slowly swallowed, so as to communicate its influence by contiguity to the affected organ; and when the symptoms are very urgent, it should also be applied over the thorax. If the patient be of a plethoric habit, the lancet may be previously employed; but, in general, it is sufficient to allow the bleeding to proceed for a short time, if it be not so copious as to threaten immediate dissolution.

In *Menorrhagia*, bleeding from the uterus, the free application of cold to the abdomen, pelvis, loins, and back, after venæsection, is one of the most powerful means we possess of checking the discharge of blood: the cold hip bath, dashing cold water, or cold vinegar and water, on the person, injecting cold water

into the vagina, and applying it, both externally and internally, to the os uteri, may be resorted to with anticipations of great advantage. The application of cold in these cases should never be entrusted to nurses or attendants, except under the superintendence of the practitioner, as faults may be committed by the improper mode of application; and, also, from want of judgment in continuing it too long after the desired effect is procured. Cold, indeed, is so exhausting a sedative, that, when the powers of life are much reduced from loss of blood, it often becomes necessary to suspend its employment; and, in fact, to take an opposite course, to rouse the powers of the system. In the greater number of cases which have come under my care, the general influence of cold has not been required, and, consequently, the most powerful of those means which insure its local effect have been selected. In floodings, I have used injections of iced water, thrown into the vagina by the stomach pump, with much advantage.

When *phlegmonous* inflammation attacks the external parts of the body, one of the means adapted to subdue it, by resolution, is the application of cold lotions, which operate, independent of their astringent or sedative properties, by abstracting heat directly from the affected part, and carrying it off by evaporation. Sometimes this refrigerant effect of lotions is more favoured by applying them tepid than cold, or even warm, when this is more agreeable to the feelings of the patient.

In *inflammation of the brain* and its meninges, whether constituting Cerebrites or Hydrocephalus, the augmented excitement within the cranium may be moderated to a considerable degree by the continued application of cold to the shaven scalp. When the symptoms are moderate, the application of *thin* pieces of linen, or of calico, kept constantly moist with iced vinegar and water, or largely diluted alcohol, or evaporating lotions containing Ether, are thought to be sufficient. In applying these, in general, the cloths are doubled, and too large; but, as the evaporation proceeds more rapidly from thin rags, and as this process is the cooling agent, whatever obstructs it should be set aside. When the heat of head and other symptoms of cerebral inflammation demand a more vigorous application of cold, ice, pounded and contained in a bladder, not more than half full, so as to permit it to be laid on the head, is to be employed. It should be kept in contact with the vertex, forehead, and temples, whilst the patient should be propped up, so as to have the head nearly erect. But the most efficient and rapid method of reducing the heat of the head, in cerebral diseases, is the direction of a stream of cold water, from the spout of a tea-pot, against the crown of the head, and continuing it for a minute, or until its full influence is felt, that is, until the excitement is obviously calmed, and collapse appears to be approaching. Indeed, so powerful

is this method of reducing the inflammatory action of the brain and meninges, that much caution, particularly in young patients, is requisite; but when it is discreetly employed, experience has fully demonstrated its salutary influence. Not to mention my own experience, which has been extensive, in those affections requiring its employment; and in which I have seen patients, whose cases seemed hopeless, recovered chiefly by its means; the writings of Dr. Abercrombie may be advantageously consulted for information on this subject. That excellent physician is a strenuous advocate for its employment in Hydrocephalus: he also recommends it in sudden coma connected with congestion of the head, and in the convulsions of children, in which, he says, it is more to be depended upon than the warm bath. How much of the effect in this application of a stream of water to the vertex, is due to the rapid renewal of the cold particles to the heated surface, or to the compression in the capillaries, by the mechanical impulse of the stream; or how much to the sudden depression of the nervous energy, extending by sympathy to the brain, is a question worthy of consideration.

In *local inflammations*, also, cold is advantageously obtained by the application of saline bodies during the time of their solution; as, for example, Hydrochlorate of Ammonia in inflammation of the testicles. In this method of employing lotions, it is scarcely necessary to say, that the production of the cold depends on the disappearance or the fixation of caloric during the liquifaction of the saline matters employed to form the lotions: the caloric of fluidity being derived almost exclusively from that which the water contains; the necessary consequence is a reduction of temperature during solution.

In applying cold to the body, in whatever manner it is applied, we should recollect that the refrigerant effect is always followed by reaction, if the cold be not maintained for a considerable time; and, as the temporary benefit is thus followed by an increase of inflammatory symptoms, cold applications in cerebral affections become more hurtful than salutary, unless their sedative influence be kept up by a steady continuance of the means, until the head no longer recovers its augmented temperature on withdrawing them. It is necessary even to let down the cold gradually, by following the use of the ice, or the stream of water, with evaporating lotions; and in no case should the hair be again permitted to grow, or the head be covered, until convalescence be fairly established. When much plethora exists, also, there is some danger in reducing suddenly the temperature of the surface, until after the vessels have been unloaded by blood-letting and active purging.

With regard to the kind of fevers in which the cold affusion or cold sponging is useful, we may enumerate five.

1. *Synocha*, or inflammatory fever, unaccompanied with

topical inflammation, although that is apt to supervene. In this fever, the heat of the skin is pungent, and the excitement excessive; the Cold Affusion rapidly abstracts the heat, diminishes the excitement, and checks the disposition to hæmorrhage, which often occurs; in which case its influence is purely sedative. It is, however, only in the early stage that it can be employed; the fatigue which it caused being too great to be safely borne in the advanced stages, in which, therefore, sponging is preferable.

2. *Typhus*—a fever directly opposed to Synocha—has been frequently suddenly checked by the cold affusion, when it has been used with the precautions which have been mentioned: but, in general, the cold sponging is better adapted for this form of fever.

3. *Synochus*—a fever at first inflammatory, but afterwards assuming the form of Typhus, has been often advantageously treated by the Cold Affusion; indeed, in the early stage of it, when no local determinations exist, nothing is so beneficial; but when these exist, much caution is requisite.

4. *Remittent fever*—a variety of fever which holds a middle rank between Continual and Intermittent fevers, in which the Cold Affusion is most advantageous when employed during the exacerbations, if the excitement run high; but, as it usually occurs, cold sponging is preferable. In the Remittents of warm climates, more especially that form which has been named yellow-fever, the salvation of the patient often depends on the cold affusion.

5. In *Idiopathic-hectic*—that is, hectic devoid of any obvious local affection, cold sponging may be employed; but in no form of hectic, whether idiopathic or symptomatic, is it advisable to use the cold affusion.

In the application of the Cold Affusion, we must carefully ascertain the exact temperature of the body. In this country, even in the severest fevers, it has rarely exceeded 108°; but in warm climates it rises to 112: but the higher the temperature is, the greater is the necessity for using the cold affusion, and the more the benefit which may be anticipated from using it. Whatever symptoms concur to demand the employment of the cold affusion, if the patient has a great dread of it, we must refrain from using it, as fear not only has prevented its beneficial effects, but has even converted it into a dangerous agent. It is, also, improper during menstruation, and in the latter months of pregnancy.

In no disease has the sedative influence of cool air displayed itself so strikingly as in *Small-pox*. During the eruptive fever, the body should be freely exposed; as it is not only benefited at the time, but the disease is rendered milder in its future stages. The presence of the eruption is no reason against the use of the cold affusion. The Hindoo doctors plunge their patients, in this

stage of the disease, into cold water, with the best results: it lowers fever, lessens the number of the pustules, and the risk of pitting. In confluent small-pox, in which the secondary fever is usually typhoid, cool air and the cool affusion may be employed in the same manner, and with the hope of equal advantage, as in typhus. In scarlatina, I have seen the fever instantly extinguished when the cold affusion was used during the height of the eruption.

It is unnecessary to enter further into the nature of the various diseases, besides idiopathic fevers, in which the refrigerant powers of cool air and water have been found productive of benefit. In all, much depends on the degree of the attendant fever. It must be left to the sagacity of the practitioner to determine whether any local affections exist which forbid the free application of either. I may, however, briefly remark, that in no disease does the powerful sedative influence of cold display itself so conspicuously as in Phrenitis. The most furious delirium is quickly subdued by allowing cold water to drop on the vertex, whilst the rest of the scalp is covered with cloths moistened with vinegar and water.

Such are the conditions of the system in which cold in every form is decidedly useful; but much, it must be admitted, depends on the discrimination, the judgment, and the observation of the practitioner, in determining the temperature of the application, the time, and the exact condition of the body in which it should be employed. It is unnecessary to add to these remarks, except to point out the means of counteracting the degree of collapse which sometimes follows the application of cold water, guttatim, to the vertex: they are external warmth, particularly the application of bladders of hot water to the scrobiculus cordis, friction, electricity, ammonia to the nostrils, and the artificial inflation of the lungs, if the degree of collapse be very considerable; and, when the power of swallowing returns, the administration of excitants, particularly aromatics, ammonia, and ether.

SECTION IV.

NARCOTICS.—MEDICAMENTA NARCOTICA*

Syn.—Anodyna†, Hypnotica‡.

Some of the distinctions between this class of medicines and Sedatives have been already pointed out; but there are

* From *ναρκοτικὸς*, derived from *νάρκη*, stupor.
† From the primitive *α*, and *ὀδύνη*, pain.
‡ From *ὕπνος*, sleep.—Hypnotic, a medicine which causes sleep.

others that require to be noticed. *Narcotics*, strictly so called, operate as diffusible excitants, and this so decidedly, that, by regulating the doses and the repetition of them, the sleep, which generally follows their administration, may be altogether prevented, and the exciting influence of the medicine only be obtained: now, the effect of a direct *Sedative* is an immediate depression of the powers of the system without any apparent previous excitement. The symptoms of collapse which follow those of excitement, after the administration of a Narcotic, are the consequence of the excitement; and, although this does not occur in the direct ratio of the degree of the excitement, yet, if it be considerable and quickly raised to its acmé, the state of collapse which succeeds is proportionate: this is not the case with Sedatives; the depression they cause is the result of a peculiar action upon the nervous system, which at once depresses it; and, if the dose be large, destroys both *mobility* and *sensibility*. In a few words, a *Sedative* immediately depresses the vital energies: a *Narcotic* augments these energies; and this excitement is followed by depression.

Regarding Narcotics in the point of view which I have described, they may be defined "Medicines which are fitted to diminish the sensibility and irritability of the nervous system, and which, in moderate doses, produce temporary excitement, succeeded by depression, and generally followed by sleep." In this definition, the soporific effect of this class of medicines is stated as one of their characteristics; but nothing is said respecting the anodyne power which they frequently also exert; for, although it is undeniable that many Narcotics are capable of alleviating pain, yet, this is not a property of all Narcotics.

As narcotic poisons do not essentially excite inflammation, Muller has conjectured that their influence depends on their "causing decomposition and the formation of binary compounds in the animal matters of the body*;" an opinion which must be regarded as purely hypothetical.

Let us examine in what manner their influence is exerted upon the organs of the body.

1. *Action of Narcotics upon the Stomach.*—The first influence of the full dose of a Narcotic, taken into the stomach, is exerted upon the nerves of that organ, and thence communicated to the nervous centres. What primary effect is produced on the organ itself, it is impossible to conjecture; but the secondary effect, that which follows the impression on the encephalon and spinal cord, is one which lowers the digestive powers of the stomach almost to a state of inaction. When the Narcotic substance is taken into an empty stomach, the first obvious effect is to diminish the desire of food: if it be taken during the time of eat-

* Elements of Physiology—Trans. by Bally, vol. i, p. 523.

ing, the process of chymification is suspended; if a short time after a meal, that of digestion is arrested; and at the expiration of some hours, vomiting follows, and the food is ejected readily in the state in which it was at the moment of swallowing the Narcotic. These effects are not confined to the action of the opium on the stomach; for they follow its introduction into the rectum, and even its application to the skin. The influence, therefore, of Narcotics upon the stomach is to weaken its powers; and, on the larger intestines, to lessen their ordinary contractility and produce constipation. Some Narcotics, however, are supposed to increase the peristaltic action of the bowels; but these are exceptions to the general rule.

The action of Narcotics upon the alimentary canal is modified by disease. When the mucous membrane is suffering from subacute inflammation, or is in a highly irritable state, Narcotics produce thirst and dryness of the tongue; and vomiting is not unfrequently induced. In a state of diminished vitality of the stomach, they augment the atony, cause indigestion, and produce obstinate costiveness. In cancer of the stomach, if no ulceration be present, Narcotics allay pain; but, when there is either an open ulcer or those spongy vegetations which occur in this disease, they cause an increase of pain, exciting vomiting and rigors, whilst, at the same time, the brain becomes powerfully affected. In irritable conditions of the coats of the stomach, however, Narcotics, especially Opium, when combined with tonics, instead of producing the effect already described, aid the influence of the tonics in promoting the appetite and favouring the digestive function. In an irritable condition also of the intestinal canal, especially when spasm is present, they produce an anodyne and a salutary effect, allaying gripings and checking diarrhœa. In peritoneal inflammation, on the contrary, they cause anxiety, general uneasiness, and vomiting; but, in ulcerations and open cancer of the mucous membrane, they allay pain and procure momentary comfort to the sufferers.

2.—*upon the Circulating and Respiratory Organs.*—Nothing is more likely to lead to diversity of opinion than the effect of Narcotics on the action of the heart and arteries. It is through these organs that narcotics are diffused over the body, the blood being impregnated with the active principle of the narcotic, which is deposited from it upon the nervous centres. A short time after taking any Narcotic into the stomach, the pulse is found in some instances small and feeble; in others, full and soft; but always more or less irregular. These effects have been referred to variations in the influence of Narcotics on the nervous energy. Their power over the circulation itself, however, is particularly manifested in the capillary system by the passive diaphoresis, the itching of the skin, and the dilatation of all the erectile

tissues, which follow the use of any Narcotic. The temperature of the body is also lowered—an effect evidently depending on the diminished action of the capillaries and the slow manner in which the blood is moved through them. When opium, also, has once entered the circulation and reached the heart, the rapidity of its influence is greatly augmented, by its action there on the minute nervous fibrils which are spread on the lining membrane of the organ. With regard to the lungs, the administration of a Narcotic is always succeeded by the number of inspirations and expirations in a given time being much fewer than natural, and consequently by an imperfect decarbonization of the circulating fluid: thence the blood sent to the head is not adequate for the due excitement of the brain, and the whole system necessarily languishes. In cases of poisoning by opium, the blood found in the left ventricle of the heart is of a black colour.

In hypertrophy of the left ventricle of the heart, the congestive influence of Narcotics is manifested by a sensation of weight of the head, a bloated aspect of countenance, and temporary deafness. In irritations of the mucous membrane of the pulmonary tubes, they diminish the tension and dryness of that membrane, re-establish the exhalation from its surface, and restore the healthy action of the mucous follicles. With respect to the influence of Narcotics on the respiratory muscles, as every muscular fibre is more or less dependent for its state of vigour upon the energy of the brain and spinal cord, the state of these nervous centres must influence the action of the respiratory muscles; and, consequently, according to the effect produced on them, Narcotics may be regarded as influencing these muscles.

3.—*upon the Capillary and Secerning System.*—With respect to the capillary system, as the velocity of the blood passing through it depends on the energy of the heart and arteries, when the action of the latter is weakened by the influence of a narcotic, the necessary sequence is the delay, almost to stagnation, of the blood in the former; the capillaries, therefore, become congested, and the parts swell. But, as the heart and arteries themselves are weakened, and make an ineffectual effort to overcome this state of capillary plethora, the pulse becomes full and labouring, the cerebral organ congested, and an explanation is afforded for the tumefaction of the face, particularly round the eyes, the passive diaphoresis, the itching of the skin, and the dilatation of the erectile tissues of the nipples in females and the penis in the male, which generally occurs. This phenomena closely resemble those which occur in asphyxia from strangulation.

When the heart is affected with disease, narcotics produce certain phenomena which should be known. Thus, if there is

hypertrophy of the left ventricle, they cause encephalic engorgements, weight of the head, partial deafness, and painful dreams. Clinical observations, says M. Barbiere, have demonstrated that opium strengthens the weak pulse, accelerates the slow, and weakens the strong: results altogether depending on the influence of the narcotic upon the cerebro-spinal centres, and that which these centres of vitality exercise over all the organs, especially the capillaries.

Little that is satisfactory is known respecting the action of Narcotics on the secreting organs. If Narcotics be administered in doses sufficient to maintain their stimulant operation, without exhaustion, there can be no doubt that the secretions will be augmented, inasmuch as the stimulus is communicated to the glandular capillaries, and an increased supply of blood afforded to them. As an objection to this opinion, it may be said that the alvine evacuations generally indicate a deficient supply of bile after opium has been taken; but, in this case, the defect depends rather upon the paralyzing influence of the opium upon the excretory ducts than upon the secreting power of the liver; and this reasoning may be extended to the rest of the glandular system. That the function of the salivary glands is affected by Narcotics, is supposed to be evinced by the dryness of the mouth which follows the administration of a full dose of opium; but this also may depend on the condition of the excretory ducts. One fact seems to confirm the opinion that Narcotics do not diminish glandular action; namely, that opium has never succeeded in lessening the flow of saliva produced by mercurials: on the contrary, it is asserted by Theussing that it has sometimes produced salivation*. On the urinary organs, some Narcotics, especially opium, produce a decided effect; hence its employment in the treatment of diabetes. But it may be questioned whether the diminished secretion of the urine be not owing to the increased perspiration which the opium induces, rather than to any influence which it exerts on the kidney? The aphrodisiac influence of Narcotics does not prove that they particularly augment the spermatic secretion. It has been asserted that opium diminishes the secreting powers of the mammæ; Geoffrey maintained that it augments them†: but observations are wanting to establish the accuracy of either opinion.

Narcotics, especially opium, have been accused of suspending expectoration. They assuredly do not diminish bronchial exhalation; on the contrary, by increasing it, and soothing the cough, by lessening the erethism which exists in the mucous membrane, they rather tend to promote than retard the ejectment of the matter to be expectorated.

With regard to the *cutaneous* exhalation, it has already been

* Charvet, de l'Action comparée de l'Opium, p. 217. † Mat. Med. vol. ii.

frequently stated, that, in large doses, Narcotics generally excite diaphoresis, from the repletion of the cutaneous capillaries. When the surface is influenced, or covered with pustular eruptions, the administration of Narcotics abates the stinging sensation, the painful heat, and the cuticular tension which always accompanies that condition of the skin.

Upon the whole, we may safely conclude that the facts which have been brought forward in proof of the influence of Narcotics on the secerning system, are not sufficient to enable any decided opinion respecting it to be hazarded.

4.—*upon the Nervous System.*—Narcotics display their influence on the nervous system in the ratio of the development of the brain and the spinal cord. In man and the other mammalia, in whom these organs are fully developed, their influence is most striking; and, as the animal descends in the scale, the intensity of action fails in proportion as the nervous centres lose their influence on the whole œconomy. Narcotics exert their chief influence on the nervous system; for, although they are undoubtedly received into the circulation, and produce almost immediate death when they are injected into the veins, yet, even in this case, it has been argued that their influence is propagated chiefly by nervous communication—a fact endeavoured to be demonstrated by the experiments of Messrs. Morgan and Addison*, who suppose that they produce on the inner coats of the blood-vessels a peculiar impression, which is conveyed to the brain along the nerves. This seems, also, to be demonstrated by the rapid effects on every part of the system, often in a space of time too short for their influence to be referred to absorption; besides, it is well known that, when the dose has been so large as to be quickly followed by fatal effects, the whole quantity of the narcotic administered has been found in the stomach. From the nature of the nervous system, there is no reason for opposing this opinion, and there appears no difficulty in comprehending the manner in which this communication of impression is effected. But if we can reason from the influence of opium on reptiles, it would appear that the effect of narcotics is confined to the nerves touched, and not propagated through them, so as to produce general poisoning. "If," says Muller, "the leg of a frog be separated from the body, the nerve only being left to maintain the connection, and is then placed in a solution of opium, and kept there for several hours, the animal suffers no narcotic influence†." If a narcotic be applied to the surface of the body, the same results follow as when it is introduced into the stomach, only in a diminished degree: but it cannot be denied that this may be the influence of absorption, as we find

* Essay on the Operation of Poisonous Agents on the Living Body, p. 73—89.
† l. c. 246.

that, when the application is to an entire membranous surface, the energy of the narcotic influence is in the ratio of the absorbing power of the membrane: and if the narcotic be injected into the thorax, between the lungs and the ribs, the action is still more rapid than when it is taken into the stomach. The fact of the introduction of narcotics into the circulation, therefore, cannot be denied; and, when a narcotic is applied to a wound, its operation essentially depends on its entrance into the blood; for its influence, in a great degree, can be impeded by a ligature on the blood vessels; and when it is injected into the veins, the animal instantly expires, without convulsions. In this experiment, all the muscles of the body, both voluntary and involuntary, are deprived of their contractile power, and, therefore, both the action of the heart and that of the respiratory muscles ceasing, death is necessarily the immediate consequence. Narcotics act on the *brain* and on the spinal *marrow* by entering the circulation, when they are taken in moderate doses; but, when swallowed in doses sufficient to prove rapidly fatal, the effect is the result of their immediate influence on the nervous energy; and, even when they are taken into the circulation, we must still refer their effects to the direct impression which they make on the nervous system; and there is some reason for supposing that they deaden the excitability by some change which they cause in the nervous matter. What the nature of this change is, we have no means of knowing; as a nerve paralyzed by a narcotic, differs in no respect from a sound nerve. This is also the case with the brain and the spinal cord, which some narcotics seem to affect in an equal degree. It is, nevertheless, certain, that Narcotics exert a local action on the nerves: a fact which is demonstrated by the anodyne effect of Morphia and its salts, when applied to a blistered surface in neuralgia: the pain is lulled without any general narcotic influence being experienced: and the experiments of Muller demonstrate that this influence "is not propagated from the trunk of a nerve to its branches*."

The nerves particularly affected by narcotics are the respiratory; for, in poisoning by a narcotic, if respiration is kept up by artificial means for a considerable time, natural breathing is re-established, all the functions of the brain are revived, and life is restored. A most respectable writer† on the action of opium asserts, that narcotics exert a powerful sedative influence on the contractile tissues, independent of the nervous centres. He, also, contends that the primary excitement is exerted directly on the brain and spinal marrow, the cerebro-rachidien centre, as he terms it, while the sedative effect is the result of the action of the narcotic on the contractile fibre. An experiment which has been frequently made, that of applying opium to the inner surface of the

* Ibid, p. 279.

† Charvet.

frog's heart, and observing that the immediate cessation of its contractions is the consequence, might be thought to confirm this opinion; and it is certainly difficult to disprove it, in the present state of physiological science; but, if the fact that the sedative influence is the effect of the previous excitement be admitted, there is no necessity for referring the phenomena to a separate action on two distinct tissues. I must not, however, be misunderstood: I do not intend to affirm that the sedative effect of a narcotic is an invariable sequence of a primary excitement; for, were this the case, we should find that all substances which rapidly exalt the powers of life would produce narcotic effects, which is not the case. Thus, we well know that when nitrous oxide is breathed, it produces a sudden and high state of excitement; yet, it is not followed by that proportional depression which is caused by a dose of opium, large enough to produce an equal degree of excitement. There is still, therefore, something connected with the operation of narcotics which we cannot explain, and which must remain a mystery until we acquire more correct ideas of the nature of nervous energy than our present limited knowledge admits.

It remains to examine generally the influence of Narcotics when applied to the mucous membranes and the skin.

When Opium, or any similar Narcotic, is injected into the rectum, it operates with the same energy, and in the same manner, as when it is taken into the stomach. Charvet, Wedelius, Delacroix, Quarin, and some other writers, think its operation is even more energetic, and caution against its employment in glysters: but every day's experience shews that larger doses of narcotics may be administered by the rectum than by the mouth.

Injections into the vagina have, also, been employed in Cancer of the uterus; but with little advantage when an open ulcer exists; and, certainly, without the smallest advantage in Hysteria, in which they were tried by Bichat. Whether the inefficacy of this mode of employing Narcotics depend on the nature of the tissue of the parts, or the difficulty of retaining the injection for a sufficient length of time, it is difficult to decide. When the irritation of an incipient Cancer interrupts the regularity of the menstrual discharge, Opium and similar narcotics calm the pains, and facilitate the discharge. Any emmenagogue property of Narcotics can only be referred to their anodyne powers.

The external application of Narcotics is as ancient as Galen, who speaks of them. Opium est narcoticum, sedativum omnis doleris, sive sit bibitum, sive sit linitum, is an observation of Avicenna.

In the external application of every narcotic, two distinct

actions take place; one *local*, and one *general*. Both are essential for allaying pain and resolving spasm. The medicine is carried to the tissues to which it is applied by imbibition, and the sedative action is thus directly exercised upon the nerves of the part; and thus external pains are soothed, when the narcotic cannot be administered by the mouth. But, besides this local influence, the same general effects may be produced as if the narcotic had been internally administered; and, on this account, it has been proposed to adopt the external application instead of the internal administration of medicines in all cases. M. Bailly and others, besides myself, have employed this method of exhibiting the salts of Morphia.

Two circumstances modify the influence of Narcotics when thus employed: 1, the extent of the surface to which they are applied; 2, the nature of the narcotic.

The action is more or less powerful as the narcotic is applied to surfaces that are known to possess absorbent powers; and, if Opium be the narcotic, the best form for external application is a solution of the narcotic in oil. The active principle is taken up by the oil, and it is more likely to be carried into the habit in an oleaginous solution than in any other vehicle.

With regard to the nature of the Narcotics, those which possess active principles, easily separated, are the most energetic when topically employed; and, if the salts of Morphia be employed, those which are most soluble are the most energetic. Thus, Acetate of Morphia is more powerfully anodyne when topically applied than the Hydrochlorate; this than the Sulphate; and all of them than the Morphia itself.

5. *Circumstances which modify the action of Narcotics.*—In whatever manner narcotics are administered, their operation on the animal system is modified by a variety of causes; the most particular of which are—1, the dose; 2, the mode of administering it; 3, the state of the system, particularly as regard the circulation; 4, sex; 5, age; 6, temperament; 7, habit; 8, climate; 9, the races of the human species; 10, individual circumstances; and 11, combination.

a. The dose.—The effect of a moderate dose of any narcotic on man is in the first instance stimulant. The activity of the heart and arteries is augmented, and a slight sense of fulness is felt in the head. Some febrile symptoms, also, present themselves, with an unusual degree of exhilaration; which, however, soon subsides, and drowsiness steals on, until it terminates in perfect sleep. If the dose be sufficient to prove poisonous, giddiness and stupor are felt without any previous apparent excitement; as this increases, the individual becomes motionless and insensible to external impressions; he breathes slowly, and his countenance denotes deep and sound repose. By degrees, how-

ever, the features change and acquire a ghastly character; the pulse sinks, and becomes at length imperceptible; the muscles relax, and death *rapidly* closes the scene.

The period in which these symtoms display themselves varies greatly, according to the kind of narcotic employed, and, also, according to the state of the patient. If opium be the narcotic, sometimes the symptoms will show themselves in a few minutes; but, in some instances, an hour has been known to elapse after a large dose has been swallowed. When a full dose of *Acetate of Morphia* is administered, besides the excitement which results from an equivalent dose of Opium, M. Bailly observed that, when the patient is in a horizontal position, he is attacked with shocks as if electrified; the head is thrown backwards as in opisthotonos; and a paralytic state of the bladder of urine supervenes, either arresting altogether the evacuation of the urine, or suspending it suddenly, at intervals, during its ejection. The sight is also sometimes so weakened that the person cannot read. M. Bailly asserts that the narcotic operates as an *excitant* on the brain, and a *sedative* on the heart. Again, when the Hydrochlorate of Morphia is employed, little or no excitant effect is perceived, whilst the sedative influence is strikingly obvious. Irregularity of arterial action characterises the operation of Conium; the pulse, in some cases, being sunk, in others elevated to 100, or more, during the whole time of administering the medicine. In over-doses, the breathing is more laborious and oppressive, and the thorax more constricted than from the action of any other narcotic; the extremities become cold, and the countenance resembles that of a man in the act of strangulation. *Belladonna*, *Hyoscyamus*, and *Aconitum*, are more directly anodyne; and, even in smaller doses, affect the sight more than other narcotics; and when the two former are over-dosed, the delirium which succeeds more resembles the extravagant ravings of intoxication than the delirium of narcotism. *Digitalis* accumulates in the system, and is more hazardous when administered in small repeated doses, than when given in a very large dose at once, in which case it operates as a soporific; whilst Veratria acts specifically on the duodenum, causing copious bilious stools, lessening febrile action, and acting as an anodyne. If the person be habituated to stimulants, many hours may pass before the stupor caused by a narcotic exhibit itself. Such a case is detailed in the nineteenth volume of the London Med. and Phys. Journal; and, in it, we are authorized to infer the diminished susceptibility of the nervous system; for collapse had already occurred: the individual who took the preparation of the opium (f℥ii of laudanum) was drunk. All that we can assert, therefore, is, that the primary action of Narcotics is stimulant; and that this is followed by a state of collapse or depression, provided nothing occurs to interrupt the usual action of the narcotic. From what

has been said, however, it is evident that the stimulant effect of narcotics may be maintained as long as the system can support a state of excitement; but, as this effect is transitory, the dose requires to be repeated at very short intervals; and it must also, as far as regards quantity, be of a nature not to operate in such a degree as to bring on rapidly the state of collapse.

Narcotics cause sleep; but, nevertheless, they cannot be employed for this purpose in cases in which their previous excitement would prove injurious, unless the dose be large enough to induce at once symptoms of diminished sensibility and action; and experience has informed us that this is the result when the dose of a narcotic is sufficiently large. In a practical point of view, the recollection of this fact is of primary importance; since the state of a patient may be either greatly improved, or materially injured, according to the extent of the dose of the narcotic which it may be thought proper to administer. Thus, if we suppose a case of pleurisy, in which the pulse is hard and quick, and the pain of the side so acute as almost to prevent a half-inspiration, so that the breathing is short and difficult; if, after a free and copious abstraction of blood, two or more grains of opium, in conjunction with calomel and tartar emetic, be administered, we may anticipate the most beneficial results: but, if half a grain only were ordered, not only would no advantage accrue from the remedy, but, its stimulant effect only being obtained, the benefit of the bleeding is likely to be counteracted, and the repetition of the dose would tend to increase the evil. In this respect, the action of narcotics does not differ from that of direct stimulants. A very large dose of alcohol, or any ardent spirit, produces a depression without any previous, perceptible increased action; whilst, in small doses, it stimulates the system, augmenting the vigour of the muscular tissue, and exalting the nervous energy. In all cases, therefore, of increased excitement, when pain or restlessness demands the administration of a narcotic, the dose should be sufficiently large to obtain, at once, its anodyne effect, without the primary excitement.

The stimulant influence of narcotics, in small doses, may be taken advantage of in the treatment of fevers of a low or typhoid type. The tincture of opium, for example, given in doses of ten minims, at short intervals, increases the strength of the pulse, frequently rouses the vigour of the system, and supports strength more effectually than either wine or any other stimulant.

b. Mode of administration and state of the patient.—Narcotics, according to the mode of administering them, and according to the extent of the dose administered, may act either as stimulants or as sedatives; and, therefore, in many morbid conditions of the habit, they may be employed to produce either of these effects. In general, however, they are exhibited with a view of obtaining that state of diminished susceptibility of impression

which is required in various diseased states of the habit; to allay inordinate action; to obtund the sensibility of the body to the impression of irritating causes; to sooth pain, and to induce sleep. How do narcotics induce sleep? is a question which is very frequently put, but scarcely ever satisfactorily answered. In replying, it is necessary to keep in view the state of the vital functions during sleep: the pulse and respiration are slower than when the individual is awake; the temperature of the body is diminished; the perspiration is decreased, and nearly all the secretions are suppressed. Now, on whatsoever principle narcotics act, if they lessen the force and frequency of the circulation, and at the same time diminish the respiratory effort, the change of the venous blood into arterial must be necessarily impeded; and this, alone, by weakening the energy of the brain, will produce sleep. I offer this explanation, however, rather as a suggestion than with any hope that it will be adopted.

d. Sex.—With respect to the influence of *sex*, women appear to be more readily affected by Narcotics than men: a circumstance evidently depending on their greater susceptibility of impressions; but the difference between the sexes in this respect is very trifling. To women in the pregnant state, Narcotics require to be administered with extreme caution; as, in this condition of the female habit, a state of the cerebral organ frequenty occurs which approximates to apoplexy, and which is augmented by the operation of narcotics, and might be productive of dangerous consequences.

e. Age.—With regard to *age*, the smallest doses of narcoties influence powerfully the infant frame, producing the most deleterious effects: drowsiness and coma, or a mortal lethargy, in a few hours: hence the great circumspection requisite in administering narcotics to children. Epilepsy not unfrequently follows the employment of opium in the diseases of infants. Idle nurses are in the habit of administering opiates to irritable infants, the consequence of which is a slow nervous fever, which the constant renewal of the narcotic influence on the habit produces. In the Causes Célèbres, is an account of a woman of the name of Suard, who was burned at Luval for destroying infants whom she took in to nurse. She put a decoction of poppy-heads into their pap to prevent them from crying. The poor children soon fell into a state of marasmus and died. She preserved the bodies in a place moderately warm, and having a current of air through it, to prevent them from putrefying; and continued to receive the money which was the wages of her services, until, at the end of some months, she exhumed them to make a declaration of their decease.

Narcotics act, also, peculiarly on *old* men. The symptoms which opium, for example, produces, are cerebral congestion, rather than irritation of the cerebro-spinal system. "We have

remarked," says Charvet, "in the great number of poisonings by opium, at this period of life, loss of consciousness, drowsiness, sudden and profound, and a general apoplectic state of habit." It is, indeed, at this period of life that the nervous centres are peculiarly predisposed to sanguineous congestions; whilst, at the same time, there is little excitability.

f. Temperament.—Temperament is universally admitted to modify greatly the influence of narcotics. In those of *sanguine* temperament, they produce a more powerful impression, than in those of a *melancholic*. The sanguine temperament is distinguished by red or light brown hair, a fair, florid complexion; the arteries and veins are large and superficial, and the pulse full and frequent; the skin is soft, thin, and delicate; and the body, which is often large and tall, is inclined to obesity. This temperament rarely displays itself in tropical climates, or in hot countries, but it is common in the temperate regions of the globe: indeed, it is peculiarly adapted to these; it suffers much from heat, but it bears cold temperatures well.

With respect to the influence of narcotics on this temperament, some authors maintain that opium acts as a stimulant on spare, sensitive, and irritable habits; but those who regard it as operating as a sedative, think that it diminishes irritability in nervous, susceptible subjects. They also affirm that, in small doses, frequently repeated, it is advantageous to persons of dry, irritable constitutions, in whom the vital movements are habitually accellerated, and who daily suffer changes which nutriment does not repair. These opposing opinions would lead us to believe, that it acts sometimes upon the nervous centres as an irritant, sometimes upon the sentient extremities and the contractile tissues as a sedative, on sanguine individuals.

But, if authors differ in opinion respecting the mode in which narcotics operate on irritable subjects, they all agree that a single large dose of some narcotics, opium for example, would prove dangerous to an individual of a sanguine temperament, in a state of plethora, which might favour cerebral congestion. The same reasons operate in forbidding the employment of opium to persons who, having passed the period of boyhood, have a short neck, the face habitually red, and the character ardent. There can be no doubt that all narcotics produce a more powerful impression on such a temperament than on the opposite or *melancholic*. In those persons who are easily affected by wine, and in whom inebriety is quickly produced, a small dose of opium causes powerful cerebral excitement. This fact was well known to the ancients; and hence the moral of Tralles—"Ille vere omnes qui vinum non bene ferunt, vix bene ferunt opium." As far as temperament is concerned, therefore, that which favours cerebral vascular irregularities should be particularly noticed, as persons of that habit are likely to be

much more powerfully affected by narcotics than the opposite state—a fact which ought never to be lost sight of in practice.

g. Custom.—Like some other excitants, narcotics lose their influence when their use is long continued; and doses have been ultimately taken which would at first have proved fatal. I knew a lady who gradually had arrived at the power of taking, three times a day, a wine-glassful of the officinal tincture of opium, a quantity equal to fifty grains of opium. Of this effect of habit, no satisfactory explanation has yet been given, although M. Charvet has attempted one. Assuming that the state of congestion of the vessels of the brain is admitted as the effect of an overdose of opium, he supposes that the frequent use of opium renders this congestion less powerful; or that the brain, accustomed by degrees to the flow of the blood and the resulting compression, at length is enabled to bear it with impunity, in the same manner as when a serous effusion *gradually* occurs, or a tumor is *slowly* developed within the cranium. It must, however, be noticed, that this modification of influence on the living system is not common to all narcotics; and, indeed, it is a curious fact, that there is less similarity of action in the different articles of this class of medicines than in those of any other of the Materia Medica. There is no class of medicinal bodies, as Dr. Paris has justly remarked, which are less disposed to bend and conform to an artificial arrangement: each seems to have its own particular mode of operation, and to affect sensibility in its own peculiar manner: thence the practitioner will often find that, after the failure of one narcotic, the administration of another will induce sleep.

h. Climate.—In noticing the effects of climate in modifying the operation of Narcotics, I may mention that Dr. Harrison has recorded two instances in which the ordinary dose, gr. iv, of the extract of henbane produced a temporary amaurosis, which disappeared, and again recurred, on the alternate suspension and administration of the medicine, when taken in Italy; although the same dose of the same parcel of the medicine, taken in England, had produced no effect of the kind. This is the case with many other narcotics: some attention is therefore required to accommodate the dose of a narcotic to the nature of the climate in which the physician is practising. Regard must also be paid to the season of the year: thus, the dose of a narcotic administered in summer requires to be smaller than one for the relief of the same symptoms, cæteris paribus, administered in winter. Hecquet explains this influence of temperature, by saying, that as heat favours the flow of sweat, the opium is carried off by it, and is thus prevented from materially affecting the brain: but Charvet supposes that, as copious sweating diminishes the mass of the circulating fluids, and renders the cerebral compression less powerful, the sweating may be regarded as a favourable crisis, which guarantees the brain from

over compression. Both opinions are hypothetical: it is more likely to depend on the greater irritability of the habit in summer than in the winter, and the consequent greater susceptibility of impression.

i. Combination.—Narcotics, when combined with other substances, are greatly modified in their effects. Thus, in conjunction with tonics, instead of checking chymification, Narcotics promote the appetite and favour the digestive function; aromatics oppose their sedative influence, and retard their soporific effects: combined with diaphoretics, whilst the function of the skin is greatly augmented, the influence of the narcotics on the brain is diminished. Acids promote their power; whilst alkalics, by decomposing the salts on which their activity depends, and withdrawing the acids which render their alkaloids soluble, diminish the action of narcotics; and, in many instances, render them inert. Astringent vegetable bodies, also, which contain tannic and gallic acid, render them inert.

k. Idiosyncracy, also, is more apt to influence the effect of narcotics than other classes of medicines. I know many individuals on whom opium operates in the most singular manner: in one lady it never produces its soporific effect until the day following that on which she takes it: and an instance of the same peculiarity in a man is mentioned by Lorry, who also details the case of a woman who was thrown into furious delirium, spasms, and convulsions, even by the external application of opium: in some persons, I have seen it produce restlessness, delirium, and convulsions; in others, a miliary eruption of the skin. We may also refer to idiosyncracy the effect of narcotics on the Malay race. When a Malay wishes to revenge some real or supposed injury, he intoxicates himself with opium, and, armed with his cress or dagger, he runs forward, striking all who happen to be in his way, until he be either disarmed or destroyed*. In the same people, also, convulsions are frequent results of large doses of opium—an effect which very rarely occurs in Europeans. This may depend on an increased degree of nervous susceptibility, and a higher exaltation of the nervous energy. It is the same condition of the system that renders infants bad subjects for the administration of narcotics: in them they produce rather irritating than calming effects: thence palpitations of the heart and convulsions not unfrequently follow the administration of opium to infants.

There are few nations, either civilized or rude, who have not recourse to the aid of narcotics, either for the purposes of medicine, or for alleviating the cares and sorrows of life. Were moral rectitude always the guide of human conduct, and were the happiness of mankind founded upon the consciousness of performing aright all the duties of his station, in the exercise of his social

* This is called running a *muck*.

relations and those of his faculties, either of body or mind, narcotics and stimulants would soon lose the value which is attached to them as aids to the pleasures of sense, and cease to be hailed as the resources of the wretched—" cura et molestia liberans, et omnium malorum oblivionem inducens." But as this is not the case, these best gifts of Providence, those designed for the removal of pain, are too often abused, and erroneously regarded as the balm of sorrow and the promoter of pleasure. " The Western Asiatic," says Christen, in his excellent work on Opium, " obtains it from his Agaric; the Southern from Opium and Bang; whilst the more polished Europeans in wine and spirituous liquors ' ducunt sollicitæ jucunda oblivia vitæ.' "

6. *Poisonous effects of Narcotics.*—Before commencing the consideration of particular Narcotics, I deem it necessary to make a few remarks on their general action as poisons. Many diseases present symptoms that closely resemble those produced by Narcotics when operating as poisons. Dr. Christison* has given the best and most succinct view of these; and, in offering the result of my own observations, I shall borrow freely from the facts which his industry and research have accumulated.

When an overdose of a Narcotic has been taken, the ordinary symptoms are headache, vertigo, dulness of vision, stupor, or perfect insensibility; occasionally convulsions of a tetanic kind and coma precede the fatal termination. Post-mortem examinations of the body display the brain gorged with blood, and frequently water is found in the ventricles. Some of the symptoms attending apoplexy closely resemble those of the narcotic poisons. They may be distinguished, however, by several circumstances: thus, if there have been warning symptoms, such as giddiness, vertigo, palsy, and noise in the ears; if the patient be above fifty, and the attack begins abruptly during a meal, or very soon after it; if, when after the sopor has commenced, the patient cannot be roused to any consciousness, and the pupils are greatly dilated, with a bloated appearance of the face, we may conclude that the case is apoplexy. There is also another symptom which is very conclusive—the absence of any odour of the narcotic in the breath; for although, after death, no trace of opium can be discovered in the stomach, yet, during life, the odour of the narcotic is generally more or less perceptible in the breath. It is only in cases of what is termed simple apoplexy that the post-mortem appearances closely resemble those displayed in the brain in poisoning by Narcotics. In congestive apoplexy, the minute injected state of the brain, with extravasation, forms a ready diagnosis; and in serous apoplexy the distinction is equally obvious.

* Treatise of Poisons, 8vo. 1829.

Between some cases of poisoning by Narcotics and *Epilepsy* the diagnosis is more difficult: for instance, the effects of Belladonna, Conium, Stramonium, and some of the poisonous Fungi, closely resemble the symptoms of Epilepsy; but the epileptic fit is more sudden in its attack; the state of sopor is different, and the patient cannot be roused from it. The sleep, also, which closes an epileptic fit terminates suddenly; the patient awakes, rises, and seems as if nothing had occurred: but the sopor of narcotics passes off slowly, and leaves the habit weak, tremulous, and exhausted. When death occurs in epilepsy, it never takes place in the first attack—a circumstance in itself sufficient to enable us to distinguish between death from epilepsy and fatal cases of poisoning by Narcotics. The distinction between Narcotic poisoning and *Meningitis,* as well as inflammation of the substance of the brain, are sufficiently obvious, although some writers have stated the possibility of their being confounded with one another: nor is there any difficulty in forming the diagnosis in *Hypertrophy* of the brain, which is always a chronic disease; and, even in the event of a sudden termination, the appearances which the brain presents are sufficient to guide the medical jurist in his decision. Instead of simple turgescence of vessels, as in Narcotic poisoning, there is unusual emptiness of the blood vessels both of the brain and its membranes, which are also, in general, uncommonly dry.

Narcotics may be arranged under two distinct heads. Those which exert a direct influence on the nervous system, without necessarily entering the circulation, may be designated *Direct Narcotics:* those which enter the circulation before acting on the nervous system, may be designated *Indirect Narcotics.* It is not my intention to maintain that the theory of the operation of direct Narcotics is exclusively that of sympathetic action; although I contend that, even when they enter the circulation, their influence is, in a great degree, exerted through the nerves. Indeed, if we admit the accuracy of the experiments of the Continental physiologists, and the inference that the Narcotic must be transmitted to the brain through the blood before it acts, the blood being impregnated with the narcotic, and thus causing a morbid change in the central organs of the nervous system; these opinions do not stand in the way of the probability that, in large doses, direct Narcotics operate by an immediate impression on the sentient extremities of the nerves; or, in other words, the local action of poisonous doses of narcotics cannot be denied.

TABLE OF NARCOTICS.

A. DIRECT NARCOTICS.

PONDERABLE AGENTS.

* *Organic Substances.*

a. MORPHIA—in the capsules of			
Papaver *somniferum.*	13.	1.	Papaveraceæ.
combined with Meconic Acid, in			
Opium;			
Extract of Poppies;			
Bimeconate of Morphia:			
——*with Sulphuric Acid,* in			
Sulphate of Morphia:			
——*with Nitric Acid,* in			
Nitrate of Morphia:			
——*with Hydrochloric Acid,* in			
Hydrochlorate of Morphia:			
——*with Phosphoric Acid,* in			
Phosphate of Morphia:			
——*with Hydriodic Acid,* in			
Hydriodate of Morphia:			
——*with Acetic Acid,* in			
Acetate of Morphia:			
Acetum Opii?			
Black Drop?			
——*with Tartaric Acid,* in			
Acid-tartrate of Morphia;			
Tartrate of Morphia:			
——*with Citric Acid,* in			
Citrate of Morphia.			
b. ATROPIA—in the leaves of			
Atropa *Belladonna.*	5.	1.	Solanaceæ.
c. DATURIA—in the herbaceous part and seeds of			
Datura *Stramonium.*	5.	8.	———
——*ferox.*	—.	—.	———
d. NICOTINA—in the leaves of			
Nicotiana *Tabacum.*	5.	1.	———
e. HYOSCYAMIA—in the leaves and seeds of			
Hyoscyamus *niger.*	5.	1.	———
f. ACONITA—in the leaves and root of			
Aconitum *paniculatum.*	13.	3.	Ranunculaceæ.
g. COLCHICIA—in the whole plant of			
Colchicum *Autumnale.*	6.	3.	Melanthaceæ.

h. VERATRIA—in the rhizomes of
Veratrum *album*. Melanthaceæ.
in the seeds of
Helonias *officinalis*. ————
i. CONIA—in the leaves and seeds of
Conium *maculatum*. 5. 2. Umbelliferæ.
k. DIGITALIA—in the leaves of
Digitalis *purpurea*. 14. 2. Scrophularinaceæ.
l. PICROTOXIA—in the seeds of
Anamirta *Cocculus*. Menispermaceæ.
m. LUPULIA—in the strobules of
Humulus *Lupulus*. 22. 5. Urticaceæ.
n. CAMPHOR—obtained from
Laurus *Camphora*. 9. 1. Lauraceæ.
Dryobalanops *Camph*. 13. 1. Dipteraceæ.
o. UNKNOWN PRINCIPLES—contained in the leaves of
Rhododendron *crysanthum*. 10. 1. Ericaceæ.
Rhus *Toxicodendron*. 5. 2. Anacardaceæ.
——in the root, leaves, flowers of
Arnica *montana*. 19. 2. Compositæ.
——in the the proper juice of
Lactuca *sativa*. 91. 1. ————
———— *virosa*. —. —. ————

* * *Inorganic Substances.*

ETHER—
* *free*—
Ether sulphuricus.
* * *Combined*—
Spiritus Etheris Sulphurici.
———— Etheris Aromatici.
———— Etheris Sulpurici compositus.

B. INDIRECT NARCOTICS.

IMPONDERABLE AGENTS.

Music;
Gentle friction.

ORGANIC VEGETABLE SUBSTANCES WHICH OPERATE AS NARCOTICS.

a. MORPHIA. L. Syn. *Morphina. Morphine.*—This is a saline body which exists in the opium, in combination chiefly with *meconic acid*, and in small quantity, also, with sulphuric acid, in the form of a bimeconate, and a sulphate. Before examining its

salts, let us enquire into the nature of Opium, and the plant which yields it.

Opium*, L. E. D. is the inspissated proper juice of the Papaver *Somniferum*†, a plant belonging to the natural order *Papaveraceæ*, a native of Persia; and also (as it is found growing naturally) of all the warmer parts of Asia, Japan, the Mauritius, Egypt, and Greece. It is now naturalized to nearly the whole of Europe, and is cultivated either for the medicinal properties of the capsules or on account of the bland, fixed oil obtained by expression from its seeds. It is an annual plant, rising from two to five feet in height, with an erect, leafy, glaucous, smooth stem. The *leaves* are amplexicaul, obtusely, largely dentate, ovato-oblong. The *flowers* are on terminal, leafless peduncles, and consist of two deciduous *sepals*, four *petals*, numerous *stamens*, and an *ovary*, crowned with sessile radiated *stigmas*. The *capsules* are ovate or globose, of one cell, containing numerous, small, reniform seeds. There are two varieties of the plant; one named the *black* Poppy (P. *nigrum*), with purple-coloured petals; the capsule opening by foramina under the stigmas, and blackish-grey seeds; the other, the *white* (P. *album*), with white petals, a short capsule, not opening under the stigmas, and white seeds. The latter is that which is generally cultivated in this country; but the former yields the best opium.

All the parts of the poppy, except the seeds, contain a white or milky-looking proper juice, possessing narcotic properties: the seeds contain a bland fixed oil and a farinaceous albumen, highly nutritive. The mature capsules are officinal.

Poppy Capsules, or Heads. *Capsulæ Papaveris (maturæ)*, L. D.—*(immaturæ)* E.—The Poppy is cultivated in many parts of Europe, as well as in England, for the sake of the capsules. They should be collected, as ordered by the Edinburgh College, in the unripe state—about twelve days after the petals fall. When they are collected in the ripe state and dried, they are inodorous, and have a bitter taste, depending on the bimeconate of Morphia which they contain.

Poppy capsules, or heads, bruised and boiled in water, in the proportion of ℥i to Oi of the fluid, form an anodyne fomentation‡. When the proportion is ℥xv of the bruised capsules, freed from the seeds, and macerated in a gallon of distilled water for twenty-four hours, and the infusion afterwards boiled down to four pints, and the fluid filtered and evaporated, an extract§ is obtained, which has the properties of opium in a mild de-

* From ὀπὸς, juice; meaning not only the juice of the Poppy, but pre-eminently *the juice*; for the same reason, as Dr. Pereira justly remarks, that Cortex Cinchonæ is called *the bark*. It is probable that the Asiatic names Afeoon, Afyun, and Aphim, were derived from the Greek name.

† Woodville's Med. Bot. 3d. edit. p. 376, pl. 138. Richard, Hist. Nat. Med. t. ii, p. 280. Lindley, 15. Hayne, vi, 40.

‡ Decoction Papaveris, L. E. D.

§ Extractum Papaveris, L. E. D. Dose, two grains to half a scruple.

gree. It contains Morphia*, but in small quantity. A syrup†, also, is made from the decoction of the poppy.

It is from the unripe capsule of the Poppy that Opium is extracted. The method of procuring it and the periods chosen for collecting it are nearly the same as those described by Dioscorides and Pliny. It is extracted from the capsule seven days after the petals fall, when the capsule begins to harden. The incisions are made with an instrument called *nahrea,* which has five cutting points; and they are repeated every second day for a fortnight. They are made both *horizontally* and *transversely,* on one side of the capsule, at night, or at least after sun-set. If we reflect that the sap-vessels, in which the proper juice is contained, run vertically, the advantage of the transverse incisions will be obvious. These vessels lie immediately under the cuticle of the capsule, and therefore it is of importance not to make the incisions too deep. The juice exudes during the night, and is scraped off with a small iron scoop on the following morning before the sun shines on the plant; and, in the evening, the capsule is again wounded, on the opposite side, for another gathering of the juice. The effluvium is so great, says M. Freygau, who witnessed the operation in Georgia, that the gatherers, who are generally women and children, are sallow, meagre, and often palsied. There are three collections from each crop, in Persia: the first, which is called *gobaar*, is strong and of a pale yellow colour; the two others are weaker than the first, and almost black. When the collection is completed, the whole of the opium is wrought up together with wooden spatulas, in wooden vessels, to the consistence of pitch: it is then formed into cakes, and covered over with poppy leaves, or the winged seeds of a species of Rumex. Such is the mode of procuring Opium in Persia, whence it is brought for European consumption, under the name of *Turkey* Opium. According to Olivier, the best Opium of Persia is that which is gathered in the southern provinces. The same method is followed in Malwah, and in Patna, where much of the East Indian Opium is collected. The collection usually occupies six weeks; men, women, and children are employed: they are called koéres. The Opium, before it is delivered to the local officers appointed to receive it, must have a consistence sufficient to prevent it from running. Some specimens of East India-opium have been sent to Europe, which, in appearance, are nearly equal to Turkey-opium: but no satisfactory analysis has ascertained the quantity of morphia which this improved Bengal-opium contains‡. Some Egyptian Opium has also been brought to England.

* Petit.

† Syrupus, Papaveris L. E. D. Dose, two fluid drachms to four fluid drachms.

‡ Opium is propably also a production of the animal kingdom: as we find that an hemipterous insect, the Coccinella *bipunctata*, ejects from its joints a yellow fluid which has a strong smell of opium.

There are four *varieties* of Opium known in commerce; Turkey, East Indian, Egyptian, and European Opium*.

a. Turkey Opium† is in thick round cakes or masses, flattish on one side and convex on the other, about two pounds in weight, and covered with the winged capsules of some species of Rumex. The best Turkey Opium is tenacious, of a clear, fresh, reddish-brown colour, changing, when kept, to a deep-brown, and breaking, when dry, with a resinous fracture. It has a heavy, strong, narcotic odour, and a bitter, acrid taste; its specific gravity is 1·336; it is very inflammable, and burns with a clear flame. When dry, it is easily pulverized, and yields a yellowish-brown powder, which is again agglutinated if wrought in the hand. Dr. Christen‡ and others state that it is nearly wholly soluble in water; but I have never met with any which did not leave some insoluble portion, generally one part in twelve; and this, when completely separated, has a plastic character, somewhat resembling the gluten of wheat, is of a deep-brown colour, and perfectly tasteless. Turkey Opium is bad when it is of a deep, almost black, colour, of a soft, plastic, unctuous or grumous consistence, or if it be friable and rough: if the odour be empyreumatic, the taste sweetish, and neither very bitter nor acrid; if it tinge the saliva brown or black when chewed; and, if it afford a deep-yellow solution with water, and can scarcely be filtered, it should be rejected.

Turkey Opium is frequently adulterated. When the adulteration is the aqueous extract of the capsules, or that of the whole plant, the Opium is blacker than usual, and it is harder; the taste is weaker than genuine Turkey Opium; it is also empyreumatic; is not inflammable; is almost totally soluble in water, and affords a turbid alcoholic solution. When the adulterating substance is the extract of the horned poppy, Chelidonium *majus*, the solution has a yellowish colour and a peculiar odour. Adulterated with the extract of liquorice, it is brittle and tastes sweet; and, with Gum-Arabic or Tragacanth, besides being fragile and shewing a smooth, shining fracture, it forms, when rubbed with one part of alcohol and two of water, a gelatinous mixture. Opium, adulterated with any fatty matter, gives a turbid tincture: when with sand and gravel, which is very common in order to increase the weight, it feels gritty between the teeth, and these matters, being insoluble, are left when it is dissolved in water§.

b. East Indian Opium, of which there are four varieties, namely, *Malwah*, *Patna*, *Garden Patna*, and *Benares* Opium, is

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* A fifth variety was sent some years ago from Trezibond on the Black Sea, but it was not bought by our druggists.

† Turkey Opium is so named, owing to its coming to Europe by the Levant, chiefly through Smyrna; but some of it comes through Constantinople.

‡ Opium historice, chemice atque Pharmacologice investigatum, per C. A. Christen, M. D. p. 23.

§ Stones and leaden balls are occasionally found in the masses or lumps of Turkey opium.

distinguished from Turkey Opium by its smell being more empyreumatic, and its taste less bitter and less acrid, than the Turkey Opium: it is also smoother, blacker, more friable; and, when triturated with water, nearly the whole is taken up, eight parts in twelve being perfectly *dissolved*, and four *suspended* in the fluid. It is known by the general name of BENGAL OPIUM; but the finest specimen of East India Opium that has been sent home, is that called Garden Patna. It is in square cakes, weighing about four ounces each, and packed in neat wooden boxes, with plates of mica between each piece*. It is not in the market.

c. Egyptian Opium resembles East India Opium in its external aspect. It is in round flat cakes, very dry, about three inches in diameter. Internally, it has a pale, reddish-brown hue, a somewhat musty odour, and a waxy lustre. It sometimes attracts moisture when exposed to the air. That formerly brought from Thebes, in Upper Egypt, was in great esteem: hence the name *Thebaicum* is still used to imply select Opium. Of late years, the Pacha of Egypt has greatly encouraged the growth of Opium.

d. European Opium is chiefly the production of France, Germany, and England. In France, however, it is rather an extract from the stem, capsules, and leaves of the unripe poppy than Opium; the object of those who have cultivated it having been rather to procure an extract containing a large proportion of morphia than real Opium†: such is the *opium indigène* of M. Ricart Duprat of Toulouse‡, of M. Loiseleur-Deslongchamps, and of M. Barbiere. M. Peyre, however, the Apothecary-general of the Military Hospital of Toulon, has prepared some Opium after the Oriental manner, in Provence; and M. Lainé has also prepared it in the same manner at Malley, near Lausanne§. In England, the efforts to make good Opium have been very successful, the experiments having been conducted on the plan adopted in Persia. The most successful English cultivators were Messrs. Cowley and Staines, in Buckinghamshire, and Mr. John Young‖. English opium, when analyzed, has been found to equal the average Turkey Opium in its proportions of bimeconate of morphia; but it has little perceptible odour of Opium, owing, it is said, to the volatile oil being dissipated by the heat employed in its preparation. Some of the best opium I have ever seen was cultivated by my friend, John Bennett Lawes, Esq. of Rothamsted, in Hertfordshire. It was collected in every respect in the same manner as the Persian Opium, and inspissated without heat¶.

* Opium is cultivated in India chiefly for the China market. In 1837, the produce was 4,060,000 lbs.

† Mem sur les Succedan de l'Opium, t. ii, p. 81. ‡ Journ. de Pharm. 1823.

§ Journ. de Pharm. vol. viii. ‖ Transactions of the Society of Arts, vol. xxxvii.

¶ Mr. Morewood states that the quantity of Opium imported into England, in fifteen years prior to 1801, was 286,271 pounds, of which 247,619, or 16,508 pounds annually, were consumed in the country; and it is probable that both the supply and the consumption are now considerably greater. Essay on Inebriating Liquors, p. 106.

Opium, whether the production of Asia or of Europe, contains *crystallizable* and *uncrystallizable* constituents. The former consists of *bimeconate of Morphia**, *Sulphate of Morphia*, *Narcotina*†, *Codeia*, *Narceia*, *Meconin*, *para-morphia*, *pseudo-morphia*, and *Sulphate of Lime* and of *Potassa*; the latter consists of *a volatile Oil*, on which the peculiar odour of good Opium depends; a *fixed Oil*, *Gum*, including *Bassorin*; *Extractive*, partly simple, partly more than usually oxygenated; *Resin*, closely combined with colouring matter; *Caoutchouc*, or rather a substance resembling birdlime; *Lignine* or woody fibre.

In taking a view of each of these components, I shall confine my remarks to those which exert some activity on the animal system, with the exception of Meconic acid; admitting, at the same time, that all of the alkaloids may more or less influence the virtues of the medicine.

Bimeconate of Morphia is an acidulous compound of Meconic acid and Morphia.

Meconic Acid‡, obtained free in a crystallized state, is generally of a reddish colour; but, when it is pure, it is in white micaceous scales. It has a slightly acid taste, slowly changing to a nauseous bitter: is inodorous: and is soluble in water and in alcohol. The solution reddens the tincture of litmus, and, when united with solutions of persalts of iron, acquires a deep cherry-red colour; a saturated blue with salts of gold; emerald-green with salts of copper; and a white with those of silver and of lead. The alkalies, chloride of tin, and nitric acid, destroy the red colour formed by the salts of iron. The discovery of this acid affords a solution of the effects of these reagents on the tincture of opium. It possesses no medicinal powers.

Meconic acid was observed to exist in opium before it was actually obtained in a separate state. It is separated from the morphia, with which it is combined in the opium, by precipitating an aqueous solution of opium by means of ammonia, or a salt of baryta, or chloride of calcium, or the acetates of lead. When ammonia is used, the meconate thus formed is retained in solution: but when a salt of baryta, or of calcium, or of lead, is employed, the meconates precipitate. These may be decomposed by sulphuric acid, and the meconic acid procured in a separate state. Other methods have been also employed: thus Robiquet prefers using magnesia for precipitating the meconic acid. This meconate of magnesia is dissolved in dilute sulphuric acid: by the addition of a solution of chloride of barium, a sulphate and *meconate* of baryta are precipitated, and chloride of magnesia remains in the solution. By digesting the precipitate in hot, very dilute sulphuric acid, and filtering, crystals of meconic acid are

* Morphia was discovered by Serturner, who also discovered meconic acid, in 1812.

† Discovered by Derrome in 1803. Codeia was the result of the labours of Robiquet, in 1824. Meconine those of Dublanc, Jun. in 1826. Narceia of Pelletier, in 1832.

‡ Named from Μηκων, the poppy.

procured as the filtered fluid cools. One disadvantage arises from the use of magnesia—it never can be totally freed from the acid.

The constituents of Meconic acid are C. 7, + H. 2, + O. 7, equiv. = 100·84*.

This acid is decomposed by boiling water, and changed into *metameconic* acid; and when sublimed, into *pyromeconic* acid†. In a greater heat, it chars and is destroyed. The exact quantity of Meconic acid in opium has not been ascertained, as it exists both in the free and in the combined state. Its only apparent use in the opium is to increase the solubility of the morphia.

Morphia, L. when pure, is in white, small, flat, hexangular, shining, prismatic crystals. It is inodorous and has a bitter taste; is scarcely soluble in cold water, and requires 500 parts of boiling water: it is nearly insoluble in ether and in fixed and volatile oils; but it is very soluble in boiling alcohol, from which it precipitates on cooling. Its alcoholic solution restores the blue colour to litmus feebly reddened with an acid; and forms crystallizable salts with the acids; thus proving its alkaline nature. When strong nitric acid is poured on Morphia, both the acid and the salt are decomposed, and an orange-red solution is produced, closely resembling that caused by the action of nitric acid on Brucia; from which, however, it is readily distinguished by the addition of solution of proto-chloride of tin to the solution, slightly diluted with water, which changes the red to violet, if the solution contain Brucia, whilst it does not affect it if Morphia only be present. When to a solution of Morphia is added a solution of iodic acid, decomposition takes place, and iodine is evolved, easily detected by mucilage of starch, producing iodide of Amidine; but a similar effect is caused by hydro-sulphuric acid, sulphurous acid, and phosphorous acid.

Morphia, when exposed to a temperature of 250°. loses 6·33 per cent. of water; it melts, if the temperature be a little higher, and, on cooling, assumes a crystalline, radiated appearance; but, in a strong heat, the melted mass is charred, white fumes are disengaged, which have an odour not unlike that of truffles; and, if the air be freely admitted, the mass burns like any other vegetable body. Strong sulphuric acid also chars Morphia.

According to the experiments of the following chemists, Morphia consists of—

	Bussy.	Pelletier. & Dumas	Brandes.	Henry and Plisson.	Liebig.	Equiv.	
Carbon	69·0	72·02	72·00	70·52	71·36	34 =	208·08
Hydrogen	6·5	7·01	5.50	7·98	6·56	18 =	18·00
Nitrogen	4·5	5·53	5·50	4·78	4·61	1 =	14·15
Oxygen	20·0	14·84	17·00	16·72	17·47	6 =	48·00
	100·0	99·40	100·00	100·00	100·00	equiv.	288·23

* Thomson.

† M. Coulant, however, has stated that when Meconate of Baryta is mixed with equal weights of vitreous Boracic acid and exposed to heat, it readily separates from the baryta, and sublimes in fine white shining scales.

It is owing to the decomposition of the natural bimeconate, and the insolubility of Morphia, that precipitates occur when the alkalies, ammonia, alkaline carbonates, acetate and diacetate of lead, salts of baryta, and astringent infusions, are added to solutions of opium.

Morphia was discovered and named by a German chemist of the name of Sertüerner, an apothecary at Eimbeck in Hanover, in 1804*; but he did not publish his method of procuring it until 1814. It has since been examined by various other chemists, particularly by Robiquet: and its properties have been fully described. It was Sertüerner who ascertained that it exists in opium†.

Morphia is separated from opium by many methods. I will notice a few only of the most approved. M. Hottet directs eight ounces of opium to be macerated in repeated portions of cold distilled water; and the filtered fluids evaporated till they acquire a specific gravity of 1·012: when half cooled, 24½ grains of carbonate of ammonia are to be added to the inspissated solution, and the precipitate allowed to fall; the fluid is next to be decanted and 141 grains of carbonate of ammonia added to it. The whole is then to remain at rest for twelve hours: after which it is to be filtered, and the residue treated with f℥xvss of alcohol and 141 grains of animal charcoal, filtering after the alcohol has boiled. As the spirituous solution cools, the Morphia crystallizes.

Instead of using ammonia, Robiquet boils the aqueous solution of opium with calcined magnesia. The magnesia decomposes the bimeconate of Morphia, forms meconate of magnesia, and throws down the Morphia, with the meconate of magnesia; by washing the precipitate, alternately, with very dilute cold and hot spirit, the colouring matter is taken up; after which, by boiling the residue in strong alcohol and filtering, the morphia crystallizes as the spirit cools.

Another method, proposed by Stratinghs, is to boil ℥viii of powdered opium with ʒvi of sulphuric acid diluted with f℥xvi of water, for half an hour, and then to strain through a linen cloth; the residue is next to be boiled with f℥xviii of distilled water, acidulated with fʒvi of sulphuric acid; and the filtered solutions precipitated with potassa. This precipitate, dried on the filter without heat, is to be boiled in f℥vi of strong alcohol. Crystals of morphia fall as the alcoholic solution cools.

A simpler method than the above is either to rub up ℥viii of opium with f℥xxx of water, acidulated with distilled

* Ann. de Physik, vol. xxv, p. 26.

† Ludwig, in his work, Dissertationes de Pharmacia, the second edition of which was published in 1668, mentions a salt which he calls Magisterium Opii, procured from opium by dissolving it in an acid and precipitating by an alkali. Wedel, in his Opiologia, speaks of the salt of opium, which Hoffman also observed, and describes its crystals as prismatic and acicular, resembling those of the flowers of benzoin. Neumann, Beaumé, and Accard, also mention the salt of opium.

vinegar, and, after filtering and evaporating to f℥x, to precipitate by ammonia. But a still simpler method is the following, ordered by the London College: dissolve ℥i of Hydrochlorate of Morphia (p. 414) in a pint of distilled water, and precipitate with f℥v of solution of Ammonia. The precipitate washed and dried is Morphia.

The chief objections to the processes for procuring Morphia in beautiful crystals is the waste of alcohol: to obviate this, Messrs. Henry and Plisson have suggested the following method of separating it from opium with a very small quantity of spirit. They rub up the opium with twice its weight of water, acidulated with hydrochloric acid, and repeat this operation three times. The filtered fluid is reduced by evaporation to ⅝, and a solution of ammonia added in slight excess. After separating the precipitate, some more hydrochloric acid is added to the mother water, which is then evaporated and decomposed as before. The residue is now to be neutralized with hydrochloric acid, boiled with animal charcoal, and evaporated to form crystals: the mother water is again evaporated to yield more crystals, and so on until all are obtained. The crystals thus procured, after three crystallizations, are to be dissolved in a water acidulated as before, and decomposed by a slight excess of ammonia. The Morphia separates under the form of a light yellow powder, free from narcotina, and furnishes, when boiled in alcohol and animal charcoal, extremely beautiful crystals*.

The proportion of Morphia procured from a given weight of opium varies according to the process employed to extract it: but the average quantity is from eight to ten per cent. East Indian yields little more than half the quantity of Turkey Opium. Egyptian, according to Merck†, affords from 6 to 7 per cent. I have made no experiments on English opium with this view, except on a specimen grown and prepared by Mr. Lawes, which yielded 12 per cent.; but, as the narcotic powers of English are equal to those of Turkey opium, we may conclude that the per centage is the same. Blitz obtained 20 per cent. from opium of the purple poppy grown in Germany; Caventou asserts that he got 28 per cent. from French opium!

Besides its natural combinations as a Bimeconate and a sulphate in opium, Morphia combines with the Sulphuric, Nitric, Hydriodic, Hydrochloric, Phosphoric, Acetic, Citric, and Tartaric acids, and forms soluble salts, all of which may be used as therapeutical agents. If the mineral acids be employed to neutralize it, they must be previously diluted with water, as the concentrated acids decompose Morphia.

Bimeconate of Morphia is readily formed by combining two equivalents, or 201·68 parts of Meconic acid (p. 409), with

* Other processes have been recommended; the latest by Merck and Dr. Mohr; but they possess no advantage over those above described.

† Pharm. Centr. Blatt. für 1836.

one equivalent, or 288·23 of Morphia dissolved in distilled water and crystallizing. The salt forms in minute irregular crystals, snow-white, if the constituents have been pure; soluble in water; the solution acquiring a cherry-red colour when tested with the persalts of iron, and yielding precipitates with all the substances which decompose the solution or the tincture of opium. The quantity of water in the crystals has not been determined; but the equivalent of the anhydrous salt is = 489·91. It is rarely employed in medical practice: but a solution procured directly from opium has lately been much prescribed*. The dose of the Bimeconate is a quarter of a grain; that of the coloured solution, m. xx.

Sulphate of Morphia.—For preparing this salt from Morphia already separated from opium and purified, the Morphia is to be gradually added to sulphuric acid very largely diluted with water, until the solution is neutralized, which can easily be determined by means of litmus paper. If wholly evaporated in this state, the solution acquires colour; therefore, after evaporating one half, it should be boiled with animal charcoal, and filtered whilst it is hot. On cooling, and after spontaneous evaporation, the salt is deposited in groups of acicular crystals. It consists of 1 eq. of Morphia, = 288·23, + 1 of acid, = 40·1, + 6 of water, = 54, making the equivalent 382·33. The salt may be prepared from Opium by the process about to be detailed for making Hydrochlorate of Morphia. The solution of the Sulphate of Morphia is decomposed by driving off all the water of crystallization; and also by potassa, soda, or ammonia, or their carbonates, and the Morphia precipitated in a nearly insoluble state: it is also precipitated by lime water, by the salts of baryta, those of lead, and all substances which have a powerful affinity for sulphuric acid. It is a useful Narcotic: the dose is half a grain.

Nitrate of Morphia.—This salt is made by adding Morphia to very dilute Nitric Acid, until the solution ceases to redden litmus paper; but it is preferable to add a small excess of the alkaloid, as the slightest excess of acid is sufficient to decompose the salt. The solution should only be moderately concentrated, and then left to spontaneous crystallization. This salt crystallizes in acicular crystals, white, very slightly tinged with pink, and displaying an alkaline reaction when their solution is tested with reddened litmus: ammonia precipitates the morphia. By analysis, this salt consists of 1 eq. of Hydrated Morphia (M. 1, + H. O.) = 297·23, + 1 Nitric Acid, = 54·15, + 2 water of crystallization, = 18; equiv. = 369·38. This salt has not been medicinally employed in this country, except by myself: it operates like the other soluble salts of Morphia, but it seems to be more anodyne than the Hydrochlorate. The dose is half a grain.

* It was first made by Mr. Squire of Oxford Street, and is sold under the name *Liquor Opii Bimeconatis*. There is some reason for supposing that Battley's *Liquor Opii Sedativus* is, also, an impure solution of the Bimeconate.

HYDROCHLORATE OF MORPHIA. *Morphiæ Hydrochloras.* L. *Morphiæ Murias.* E.—This salt may, also, be prepared by the direct combination of its constituents, dissolving the Morphia in dilute Hydrochloric acid; it is thus obtained in the form of tufts of prismatic crystals, devoid of colour. The London College orders it to be prepared by precipitating a solution of opium by means of chloride of lead in solution; pouring off the supernatant fluid, adding to it the washings of the precipitate, which is a meconate of lead, and evaporating the mixed fluids to crystallization. The crystals are to be pressed, then redissolved, and again, and a third time, crystallized, until they are snow white.

The Edinburgh College orders the solution of opium to be precipitated by chloride of calcium in excess, washing the precipitate, which is a meconate of lime, and evaporating the mixed fluids to crystallization: after pressing the crystals, they are again to be dissolved, and, with the addition of a little powdered white marble and hydrochloric acid, the solution and crystallization are to be repeated until pure crystals are obtained.

My method of preparing it is, first to form a concentrated aqueous solution of opium, by macerating the sliced opium for twenty-four hours, then pressing it; and, after mixing the marc with pure white sand, to form it into a paste, and exhaust the soluble matter of the mass, by passing tepid distilled water through it in a percolater, until the fluid comes off colourless and tasteless. This solution, concentrated, is next to be decomposed by diacetate of lead, which throws down an insoluble meconate of lead, and leaves an acetate of morphia in solution. After washing the precipitate and mixing the washings with the solution of the acetate, sulphuric acid is to be added in excess, to throw down any oxide or acetate of lead, and convert the acetate of morphia into the sulphate. After driving off the acetic acid by boiling the solution, the sulphate is to be decomposed by chloride of barium; a meconate of baryta is precipitated, and a soluble Hydrochlorate of morphia remains in solution. The crystals formed by evaporation, being coloured, require to be pressed, redissolved, boiled with animal charcoal, and recrystallized; and, by repeating the crystallization, pure crystals, in beautiful silky tussocks, are obtained. By this process I have procured from 10 to 13 per cent. of pure Hydrochlorate, from Smyrna opium.

Hydrochlorate of Morphia has a bitter taste: it is permanent in the air: its solution is decomposed by the alkalies and their carbonates, by magnesia, lime-water, nitrate of silver, acetate of lead, phosphate of soda, and infusions and decoctions of astringent vegetables, which, therefore, cannot be prescribed in conjunction with this salt; but it is not affected by the chloride of barium, nor by carbonate of magnesia, nor bichloride of mercury, which may, therefore, be prescribed with it. It is soluble in 16 parts of water at 60°; and when a saturated solution in boiling water is left to cool, it congeals in a crystalline mass. It is so-

luble in alcohol. Its composition is 1 eq. Morphia, = 288·23, + 1 Hydrochloric acid, = 36·42, + 6 Water, = 54, equiv. = 378·65. This is the best of the salts of Morphia, affecting the head very little, and displaying only moderate exciting powers. Its dose is from one fourth to half a grain.

The Edinburgh College orders a solution of the Hydrochlorate, under the name *Morphiæ Muriatis Solutio*. E. It is made with ʒiss of the salt, f℥v of rectified spirit, and f℥xv of distilled water. The dose is m. xx to m. xl.

Phosphate of Morphia.—This salt is prepared by combining the constituents in the same manner as for the preparation of the Nitrate. The crystals are beautiful, white, silky-looking, acicular prisms. Their solution gives an alkaline reaction, and deposites morphia on the addition of ammonia. The salt is probably a compound of 2 eq. Hydrate of Morphia, + 1 Phosphoric acid, + 10 Water, equiv. = 752·86. It has not been medicinally employed.

Hydriodate of Morphia.—This salt is prepared by stirring together concentrated solutions of one part of Iodide of Potassium, and 2 parts of Hydrochlorate of Morphia; the Hydriorate of Morphia falls down, and must be collected on the filter. It is then to be pressed between folds of bibulous paper, redissolved in warm distilled water, and crystallized. The crystals are white prisms. This solution has an alkaline reaction. Ammonia precipitates the morphia. The constituents of the salt are—1 eq. Hydriodic acid, + 1 Morphia, + 2 Water, equiv. = 423·53. It has not, to my knowledge, been medicinally employed.

Acetate of Morphia. *Morphiæ Acetas*. L. E.—This salt is best prepared by adding Morphia to diluted acetic acid, until litmus paper is no longer tinged red. The solution is then to be evaporated to dryness, and the salt reduced to a powder, and kept in well-stopped phials. The manner of effecting this evaporation is apt to vary the strength of the preparation: if it be conducted in vacuo, the salt may be obtained in crystals. The London College orders it to be prepared with ʒvi of Morphia, fʒiii of Acetic acid, and f℥iv of distilled Water. The Edinburgh College orders the precipitate from the solution of the Hydrochlorate, acted on by Liquor Ammoniæ, to be dissolved in diluted Pyrolignous acid in slight excess, concentrating the solution and crystallizing. The Acetate crystallizes with difficulty: it is partially decomposed when it is dissolved in water; hence it is preferable to keep it in solution of a definite strength, acidulated with acetic acid. The constituents of the acetic acid are 1 eq. Morphia, = 288·23, + 1 Acetic acid, = 51·48, + 1 Water, = 9, eq. 348·71. This Acetate is probably the active ingredient in the Black Drop. It is the active constituent in the Acetum Opii. E. D. twenty minims of which are equivalent to thirty of the officinal Tincture of Opium. Acetate of Morphia possesses one advantage over all the other salts of

Morphia:—it may be administered in combination with the salts of lead. Its solution is rendered blue by sesquichloride of Iron. The dose is one-fourth of a grain to one-half of a grain.

TARTRATES OF MORPHIA.—Morphia unites with Tartaric acid in two proportions, forming two distinct salts.

a. Acid-Tartrate of Morphia is prepared by dissolving Morphia in a solution of Tartaric acid, taking care that the acid predominates; filtering and crystallizing. The crystals are flat prisms, not pure white; their solution reddens litmus; it is decomposed by ammonia. This salt is a bitartrate, with two equivalents of water of crystallization, equiv. = 489·19.

b. Neutral Tartrate of Morphia is formed by saturating a solution of Tartaric acid with Morphia. As the solution is concentrated by evaporation, irregular, dark-coloured, very soluble crystals are formed, and adhere in masses, that form, when dried, a brown cake, which yields a dirty-white powder. The solution has an alkaline reaction, and throws down Morphia on the addition of ammonia.

The acidulous tartrate is an useful salt. The dose is half a grain.

CITRATE OF MORPHIA is also formed by the direct combination of its components. It has only been used in solution, in a preparation* which has not come into general notice.

b. NARCOTINA†.—This salt has been supposed, by M. Majendie and others, to be the stimulant principle of opium; but this opinion was soon found to be too hypothetical to be adopted‡. In the crystallized form, it is in white, inodorous, insipid, thin, pearly tables, when crystallized from alcohol; in rhomboidal prisms, when crystallized from ether. It is scarcely soluble in water, but very soluble in alcohol, in ether, and in volatile oil. It does not display the alkaline properties of morphia. It is easily distinguished from morphia by putting some of it on blotting paper and submitting it to a moderate heat: it melts and is imbibed by the paper as if it were resin. *Narcotina* exists uncombined in opium; it is readily procured by digesting, in ether, the marc which remains after the separation of the matters soluble in cold water from opium. The etherial solution is to be distilled to save the ether, and the residue treated with weak alcohol, which only takes up the narcotina. If it be really the stimulant principle of Opium, the proposal of Robiquet to separate it by agitating the extract of opium with ether, as

* Dr. Porter's solution of Opium in Citric acid.

† This name is derived from ναρκωτικὸς, narcotic.

‡ Orfila and Dr. Bally assert, that when Narcotina is dissolved in very dilute hydrochloric acid, it may be given with impunity in doses of sixty grains: but half that quantity dissolved in weak acetic acid produces the same effects that occur in cases of poisoning by the salts of Morphia. One curious circumstance follows the administration of the acetate to dogs: in doses of gr. xxiv, it produces convulsions, with a strong impulse to move backwards.

soon as it acquires the consistence of syrup, by which the narcotina is taken up, would greatly improve this preparation. Narcotina has been used in India, as a substitute for the salts of Quina, in intermittent fever. Dr. O'Shaughnessy has recorded nearly two hundred cases of remittent and intermittent fever successfully treated with it.

d. CODEIA*.—This salt, in the form of a Hydrochlorate, crystallizes along with Hydrochlorate of Morphia, from the solution of which it is separated by precipitating the morphia by ammonia, which leaves the salt of Codeia in solution. By evaporating, and acting upon the residue with hot ether, and leaving the solution to spontaneous evaporation, the Codeia crystallizes in flat, colourless, transparent octahœdral crystals. Water at 60° dissolves 1·26 per cent. at 212°—5·9. The solution has an alkaline reaction. It is distinguished from morphia by its greater solubility in ether, its insolubility in alkalies, and in not being reddened by nitric acid. Its constituents are C. 35, H. 20, N. 1, O. 5, equiv. = 288·35. It operates as a sedative. Its dose is from gr. i to gr. iii.

e. NARCEINE†.—*Narceia* is obtained from the fluid which remains after the morphia and narcotina have been separated, by adding to it baryta, so as to neutralize all the meconic acid. The excess of baryta is to be separated by carbonate of ammonia; after which, the fluid is to be concentrated, and left at rest in a cool place, until a deposit is formed, which is to be pressed through linen; and, after being treated with alcohol, and passed through pure charcoal, left to crystallize. The crystals thus procured are Narceia: they are white, silky, quadrilateral prisms; soluble in alcohol, and in 2·37 parts of water, at 60°; insoluble in ether; and having a bitter, styptic, metallic taste. They melt at 199° Faht. and at a higher temperature are decomposed: when combined with concentrated acids, they strike a beautiful blue colour and form neutral salts. They form, also, a bluish compound with iodine. Pelletier regards the following as the components of Narceia: Carbon 54·73, + Nitrogen 4·33, + Hydrogen ·6·52, + Oxygen 34·42, = 100; or, C. 28, H. 20 N. 1, O. 12, equiv. = 301·51. The action of Narceia on the animal œconomy is unknown.

f. MECONIN‡.—*Meconina* is obtained from the ether used to procure the narcotina. It is in six-sided crystals, with dihedral summits, devoid of odour, and impressing a slight degree of acrimony only on the palate. It fuses into a limpid fluid at 194°. It is soluble in water, alcohol, and ether: its solution displays no alkaline reaction. Cold sulphuric acid does not carbonize the

* Named from κωδεια, a poppy capsule It was discovered by Robiquet, in 1832.
† Named from ναρκη. It was discovered by M. Pelletier, in 1832.
‡ Named from μηκων, a poppy.

Meconina, but simply dissolves it; but the hot acid turns it black. Chlorine gas reddens it when it is fused; and, on cooling, the mass crystallizes. The constituents of Meconina are C. 10, H. 5, O. 4, equiv. = 98·20. It exerts no influence on the habit.

It is unnecessary to enter into a detailed description of paramorphia, pseudo-morphia, and porphyroxin, a new principle found by Merck in Bengal Opium; nor is it essential to notice particularly the uncrystallizable components, with the exception of the volatile oil and resin.

g. The *volatile oil,* although affording a powerful odour to Opium, yet is in such small quantity that it can scarcely be procured in a separate form. Water in which Opium is distilled, acquires a turbid milky aspect, owing to its taking up a small portion of the oil; and, on this account, the distilled water was at one time thought to be narcotic; but it has been given to animals in large quantities without producing the smallest narcotic effect. When administered to man, it is productive of that slight cephalalgia which many other odours excite.

5. The *Resin.* Pelletier has ascertained that this differs from common resin in not being soluble in ether, although it is soluble in alcohol and in solution of pure potassa. Its components are—

Carbon	59·825	or	16 eq.	=	97·92
Nitrogen	4·816		1	=	14·15
Hydrogen	6·813		23	=	23·00
Oxygen	28.546		6	=	48·00
	100·000		Equivalent		183·07

Before the discovery of the Bimeconate of Morphia as the active principle of opium, this resin was regarded as a very important component of the drug; and to its presence the stimulant quality of the medicine was referred. It exists in not more than nine per cent.

Physiological influence.—The manner in which Opium acts upon the animal œconomy involves an enquiry of great importance and deep interest, in a practical point of view: in proceeding with it, let us first enquire into its operation in the form in which Nature has supplied it, the simple, inspissated, proper juice of the Papaver *Somniferum,* or OPIUM; and afterwards into the peculiar effects of the most active of the principles which chemistry has extracted from it, namely, *Morphia,* and its compounds.

The writings of Hippocrates inform us that the most striking effect of the operation of Opium on the animal œconomy, its soporific power, was known to the Greeks; as we find in them the phrase υπνοτικον μηκωνιον, the sleepy juice of the poppy. But,

nevertheless, the introduction of Opium as an article of the Materia Medica is due to Serapion, the chief of the Empirics who flourished 248 years before the Christian era.

Like all other narcotics, the primary effect of Opium is excitant; but it operates as an anodyne and hypnotic, also, according to the mode of administering it, and the condition of the patient. The experiments of Charvet* have demonstrated that its influence is not confined to the human species, but is felt by all animals, mammalia, birds, reptiles, amphibiæ, fishes, zoophytes: it is doubtful whether it influences the vegetable œconomy. On the human race, its effects are produced, whether it be introduced into the stomach or the rectum, or inserted into a vein, or applied to parts endowed with great sensibility, or to wounds and ulcers, or to the surface of the body, even when the cuticle is entire. The exciting effect first produced is followed by depression, sopor, and coma; and, if the dose be large, death ensues. In the mammalia, with the exception of man, no cerebral congestion is induced: in them it operates on the general nervous centres as an irritant, and death takes place amidst convulsions.

When taken into the stomach of a healthy man, Opium undergoes partial digestion; the inert parts of its components pass into the composition of the chyme, in the same manner as ordinary food; but, during this process, some degree of fulness is felt at the epigastrium, and the sensation of hunger, if it existed, disappears. In the mean time, the active principles of the Opium, being probably in a great degree separated from its other components, begin to display their influence on the nervous system, by a sensation of heat in the face, and some degree of distension in the temples: these feelings are followed by hilarity of mind, and a vivacity of imagination, similar in many respects to that resulting from the use of wine or alcohol. The vascular system is excited, and the pulse continues augmenting both in force and in frequency for nearly half an hour; after which it declines, but more gradually than it rose. The muscular powers then seem to flag, and the impression of external objects is less sensibly felt, accompanied with a desire for repose. These effects in some degree follow the use of ardent spirits; but Opium, however, produces effects both *similar* and *different* from those of wine and alcohol. Like wine, it rouses the animal appetites and inspires courage; so that the Turks, and other Oriental people, employ it as an aphrodisiac, and before going into battle. During the existence of its exciting influence, whilst mental energy and the corporeal powers are considerably augmented, the cuticular secretion is increased, but some of the other secretions are diminished. The urine is scanty and high-coloured; and the pale clay-coloured aspect of the alvine discharges seems to indicate a

* De l'Action comparée de l'Opium.

greatly diminished excretion of bile, although, from the turgid state of the biliary ducts, in those poisoned by Opium, it is evident that this secretion is augmented: its flow into the duodenum only being diminished. Such are the primary effects of Opium: if the dose be not repeated, the person gradually becomes dull and languid, and sleep ensues. This sleep, however, although sometimes like "the golden slumbers of repose," yet, is also as frequently disturbed and restless, and accompanied with the most terrific visions.

If the dose be large enough to prove fatal, the effects are giddiness, stupor, and those of a sudden depression of all the powers of life; the sleep, that quickly follows, appears at first deep and perfect; the breathing is slow and soft; the eyes are shut and the pupils contracted; by degrees, however, the sleep assumes the semblance of that caused by sanguineous compression of the brain; and it is sometimes accompanied by stertorous breathing, as in apoplexy. There are also the same cold sweats, and, occasionally, convulsions: but the state of the pulse differs greatly from that attending apoplexy, being small and less frequent, instead of full and quick. As the influence of the poison increases, the countenance becomes ghastly, the pulse feeble and imperceptible, the muscles relaxed, and death follows. Sometimes no apoplectic symptoms supervene; but the fatal event steals on imperceptibly, and the person expires as if in a deep and sound sleep: on the other hand, Nature has been known to bear up against the force of the poison, and the patient to awake, after a long sleep, without any consciousness of what has passed.

If the dose of Opium be moderate, and not repeated, its effects upon the habit gradually subside, and the health remains unimpaired: but if it be large, or have been frequently or daily repeated, it wears out the powers of both mind and body: the person becomes melancholy, dull, stupid, and unfit for the business of life: emaciation follows; and his countenance, "like the title-page of a tragic volume, foretells the issue;" he sinks into a state of premature old age; palsy generally seizes him; or, as a drivelling idiot, he dies in a state of the most miserable fatuity.

The truth of this description is attested by the accounts of those who have travelled in Turkey, and who have been capable of forming an accurate opinion on the subject. Opium eaters seldom, at first, contemplate pursuing the practice to the extent to which it has often been carried. They begin with small doses and gradually increase the quantity until it amounts to one or two drachms; and the habit becomes so confirmed, that, without this usual dose, the life of the opium eater is miserable. It can only be discontinued by mixing it with some inert substances, and diminishing the opium daily, until the habit is destroyed. The smoking of opium is as detrimental to health as eating it, when it is carried to excess. The preparation called

Chandoo, used for smoking, in China, is a simple watery preparation of the drug. A piece, about the size of a small pill, "being put," says Marsden*, "into the small tube which projects from the side of the opium pipe, that tube is applied to a lamp, and the pill, being lighted, is consumed at one whiff or inflation of the lungs, attended with a whistling noise. The smoke is never emitted by the mouth, but usually receives vent through the nostrils, and sometimes, by adepts, through the passage of the ears and eyes."

Let us now enquire upon what principles these effects can be explained. In this enquiry, five important queries present themselves:—1. Is the primary action of Opium always stimulant? 2. On what does its sedative effects depend? 3. Upon what part of the animal organization does it directly operate? 4. Is its general influence on the habit sympathetic, or is it absorbed into the blood? 5. How is its action modified by *age*, *sex*, *temperament*, *habit*, *climate*, and other circumstances?

1. With regard to the first object of enquiry, although I have stated that the primary effect of Opium is stimulant, yet, upon this point there have existed great differences of opinion. It is not my intention to discuss opinions; let us look to facts. When taken into the stomach, Opium causes a sensation of heat, quickens the pulse, excites the system, and exhilarates the mind. If it be dissolved in water, and applied to the eye, to the urethra, or any tender, irritable surface, it, at first, causes pain; and the same thing occurs if it be applied to a denuded muscle. These effects are analogous to those of other excitants; they take place both in the healthy, and also in the diseased condition of the habit. Numerous instances might be adduced of the primary excitement which it produces. In the Teriakihana, the opium shops of Constantinople, it is mixed with rich syrups and confections, and taken in divided doses of from ten to one hundred grains. The sombre Turks sit in a row, and the person who administers the drug as he passes along, throws, into the open mouth of each, a small lozenge† containing the apportioned dose. This is repeated at certain intervals, until the symptoms of intoxication present themselves, when the delirious Turk is thrust out of the house, and reels along the streets in the same manner as the habitual drunkard, after his usual dose of gin or brandy. De Tott, in his Memoirs of the Turks, mentions that his language master used to get drunk and poetical with Opium or brandy indiscriminately. The stimulant effect of Opium in supporting the Turkish couriers in the long and rapid journeys which they perform, without tasting food, is another unanswerable proof of its exciting properties. In disease, also, its exciting

* Hist. of Sumatra, 3rd edit. p. 278.

† These lozenges are stamped with the words *Mash Allah*, "the gift of God."

power is equally conspicuous: hence, in the low and sinking stages of typhus, it is often advantageously administered in small, frequently repeated doses, instead of wine: and hence the injury it causes in all cases of existing excitement: as, for instance, in affections of the chest, attended with an accelerated circulation, and hard, dry cough. But, in stating this fact, it is also necessary to add, that much depends upon the *extent of the dose,* and the *mode of administering the medicine;* something on the *state of the stomach* at the time; even on the *hour of the day* at which the dose is given; and the *tissue* to which it is applied.

a. If the dose be small, that is, from a quarter of a grain to a grain, in about three-fourths of an hour after it is taken, besides the symptoms already described, the mouth and the pharynx become dry, and the pulse is accelerated; but, at other times, it is contracted, unequal, and intermitting. If the dose be from two to three grains, in addition to these symptoms, in an augmented degree, there is the sensation as if an ample meal had been taken; the pulse is frequently full and strong; the patient restless and fidgety: and, with the mental excitation, there is often more or less of a tinge of melancholy, according to the natural bias of mind of the individual. After a short time, the sensation of oppression at the stomach increases to nausea, and sometimes to vomiting, which is followed by an overpowering inclination for repose; exterior impressions are feebly perceived, the ideas become vague and indistinct, and sleep supervenes. During this sleep, which is far from being natural, the pulse continues slow and full, the respiration is deep, and a profuse sweat bedews the whole of the body. On the following day, all the feelings that usually succeed a debauch of wine are experienced, with a torpid state of the bowels. If the dose be still greater—if, for instance, from ten to thirty grains be taken, and not quickly rejected by vomiting—the primary excitement is scarcely perceptible; the pulse is small, rarely accelerated, but rather slow and irregular. In a short time, however, extreme agitation, tremors, anxiety, and spasmodic twitching of the tendons, come on; these are soon followed by a flushed face; the eyes are brilliant and prominent; the pupils dilated and immoveable; the look fixed and stupid; and throbbing of the carotids indicates a high cerebral action. In this state, the patient may be roused from the comatose sleep which stupifies him; but, as soon as he answers any question, he again drops asleep; the respiration becomes laborious and stertorous; occasionally, it appears interrupted altogether for a few moments; cold sweats, with a feeble intermittent pulse, follow; and the sedative influence of the medicine is felt in every part of the system. At this period the fate of the patient is inevitable: the whole muscular power becomes paralyzed; liquids fall into the œsophagus as if into an inert tube: the destroyed irritability

permits great distension of the intestinal canal, the respiratory muscles cease to act, and death supervenes in the midst of combined symptoms of asphyxia and apoplexy. In these results of the administration of Opium, the stimulant and sedative influence of the medicine is obvious when the dose is moderate; but when it is very large, the sedative effects supervene without much previous excitement: so much is the operation modified by the extent of the dose.

b. With respect to the mode of administering the medicine: if the effects of a moderate dose of Opium are dissipated, the administration of a smaller dose, after a short interval, produces more intense effects than the first dose; although the reverse of this follows the continued use of the drug.

c. If the stomach be empty when the Opium is taken, the excitement is great, the pulse remains small and hard, and symptoms of cerebral congestion rarely appear; on the contrary, if the same dose be taken after a meal, congestive phenomena appear soon and are very obvious.

d. With respect to the influence of the period of the day in which the Opium is administered: if a grain be taken into a fasting stomach in the morning, the excitement is great, and sleep seldom follows; if the same dose be taken in the evening, scarcely any excitement supervenes; or as soon as the first symptoms of it appear, the desire of sleep is overpowering. The sleep, however, is not sound, but is disturbed by dreams; a bitter taste is felt in the mouth, and costiveness is as great on the following day as if a large dose had been taken. It has been asserted that Opium exhibited per anum has a much greater influence upon the habit than when it is taken into the stomach; and this is said to be owing to the gastric juices altering the nature of the medicine and weakening its narcotic power; whilst in the rectum, if the gut be not loaded with fæces, the Opium is rapidly carried into the system. But this reasoning is more specious than true: the gastric action tends merely to disengage more quickly the morphia, which is indigestible, whilst no such evolution takes place in the rectum. Hence, notwithstanding the results of some cases, much larger doses of Opium can be administered by the rectum than by the mouth. Such are the facts which establish the primary stimulant influence; and the secondary sedative effect of the internal administration of Opium.

e. Opium produces the same effects if it be administered by application to a denuded surface, or endermically, as when it is taken into the stomach. Its influence is rapid when thus applied; but the dose requires to be large.

2. With regard to the nature of its sedative influence.

Some experiments of Dr. Crumpe threw considerable light upon this subject. He separated the skin from the muscles in

the posterior extremities of several frogs. On some he poured a strong watery solution of Opium, on some ammonia, on others alcohol, and through some he passed electrical sparks. The limb, in every instance, was deprived of sensibility and motion; this followed the use of the Opium in ten minutes, the alcohol in three minutes, the ammonia in one minute, and the electricity in an imperceptible space of time. On cutting out the heart of a frog and subjecting it to the same substances, he found its irritability destroyed by the Opium in ten minutes, by the alcohol in three, by the ammonia in two, and by electricity in a moment. In another experiment, having brought the heart into view, and injected the Opium, the alcohol, and the ammonia, into the intestines, he found that the action of the heart was at first excited by all of them; but its velocity soon gradually diminished, and its action at length altogether ceased. From these experiments, it is evident that opium excites the powers of the system, and that its excitement is followed by collapse; that its sedative influence, therefore, is the result of its primary excitant action; and that the degree of this is in proportion to the violence of the primary excitement. But opium produces, also, peculiar effects dependant on its sedative influence. Thus, the sleep which follows the excitement of this narcotic is not that which follows the intoxication of alcohol; and no ordinary excitant possesses the anodyne power of Opium. It is, therefore, fair to conclude, that, although Opium is a substance possessing some properties in common with other excitants, yet, at the same time, it possesses some peculiarities, as far as concerns its sedative, soporific, and anodyne influence over the living system, distinguishing it from all other substances.

3. With respect to the part of the organization on which the influence of Opium is chiefly exerted, there is much diversity of opinion. The early opinions are scarcely deserving of attention. Among those requiring notice, is that of Fontana, who, from some minute experiments, drew the following conclusions:—That the blood is the medium through which Opium acts, and that it operates independently of the nervous system. He drew this inference from observing, that when it is applied to the brain or the nerves, it produces no effect; that when the heart of a frog is cut out and placed in a solution of Opium, it is not deprived of its irritability sooner than when it is placed in common clean water: but that when the Opium is injected into the veins, it instantly causes death. Some physiologists, again, have supposed that it acts solely on the muscular fibre, destroying its contractile power. But it may, nevertheless, be laid down, as an axiom, that opium operates on the brain and the nervous system.

With regard to the part on which it more immediately operates, it has been maintained by Dr. White and Dr. Alexander,

that it acts on the part to which it is applied. In support of this opinion, they contend—1. That the action of Opium, in large quantity, is so sudden that there is no time for absorption. 2. That when a small quantity is injected upon the heart, the irritability is destroyed, and death generally ensues. 3. That when, instead of throwing the injection into the heart, it is introduced only beneath the skin, the irritability of the heart remains for a considerable time after death—a proof that no Opium had reached it; that when the transmission, by the absorbents, is cut of, the effects of the Opium are still felt over the whole system; and, lastly, that it causes a paralytic condition of the muscles of the parts. The contrary opinion was maintained by the elder Monro and others, who maintained that, after the nervous connection between the trunk of the body and the extremities is destroyed, still Opium applied to the limbs produces the same effect as when the connection is entire; that when a large portion is exhibited, all the excretions, the milk, the urine, the perspiration, smell of Opium; and that the application of it to the surface relieves pain in a distant part, in the same manner as if it had been taken into the stomach.

4. Although my own opinion is, that Opium acts upon the habit independent of the medium of the circulation, yet I do not deny that it is also taken into the circulation under peculiar circumstances: but such an absorption is not essential to the production of its effects. The most formidable arguments in favour of absorption are the following:—1. The time which supervenes between taking a dose of Opium and the manifestation of its influence on the system—being sufficient for the absorption of the narcotic. We must nevertheless recollect that the intimate combination of the bimeconate of morphia with the other constituents of the drug requires some time before it can be so far separated that it can act with energy on the sentient extremities of the nerves of the stomach; and we find that the time which supervenes is in the direct ratio of the state of solution of the Opium. 2. The augmentation of the symptoms during ten or twelve hours, although the Opium is as much in contact with the nerves in the first quarter of an hour as at the end of the twelve hours. This certainly appears to indicate absorption. 3. The greater influence of morphia combined so as to form a soluble salt, than in its pure insoluble state. But it is obvious that whatever operates on the nervous system is likely to prove more energetic in the ratio of its solubility; so that this supplies no argument in favour of absorption. 4. The rapid effects which follow the injection of the opium in solution into the veins. I shall have occasion very soon to explain the reason why this effect should take place, even if the hypothesis of direct action on the nervous system be regarded as applicable to Opium. It must, however, be admitted that there are facts which tend to

shake the opinion that the whole effect of Opium results from its direct influence on the nervous system. One of the strongest is, that an infant is affected through the milk of the mother who has taken a large dose of Opium. Still, there are phenomena attending the administration of this narcotic that cannot be explained, in any way, by the doctrine of absorption, nor without admitting the influence of a direct impression on the nerves. It is by this supposition only that we can explain the fact that many of its most striking effects take place long before any appearance of cerebral congestion is evident; namely, the dilatation of the pupils, the immediate relief which its application affords to a decayed tooth when under the influence of toothache, and the immediate effect of opiate frictions in allaying local pains. It is only by admitting the influence of Opium on the sentient extremities of the nerves, that we can readily explain the relief obtained in these instances.

5. Passing from conjectural points, on which a difference of opinion must always exist, let us now enquire what circumstances influence the action of Opium on the system.

a. Age has a powerful influence in modifying the action of Opium. The younger the individual, the more energetic is its influence on the system: hence the caution requisite in its administration to infants, in whom it proves more irritating than sedative; and instances are recorded in which convulsions and even epilepsy have followed its administration to children. In general, even in the form of syrup of poppies, a preparation too frequently given to children by lazy nurses, marasmus follows its frequent use, with a slow nervous fever, depending upon the continued cerebral excitement produced by the medicine gradually undermining the powers of the constitution.

b. Sex influences the operation of Opium less than any other circumstance; but still we find that spasms, dyspnœa, and obstinate vomitings, more frequently follow its use in *women* than in *men*.

c. With regard to *temperament*—Opium influences those of a *sanguine* more than those of a melancholic temperament; those who labour under plethora, likely to favour cerebral congestion, than those in a spare condition of habit—facts which ought never to be lost sight of in practice. In those individuals also who are easily affected by wine, and in whom inebriety is quickly produced, a small dose of Opium causes powerful cerebral excitement: hence the truth of the maxim of Tralles—"Illi vero omnes qui vinum non bene ferunt vix bene ferent opium."

d. Custom powerfully modifies the action of Opium on the animal system. Custom diminishes the susceptibility to the influence of opium in every one: indeed, the enormous doses of it taken with impunity by individuals who have long accustomed

themselves to the use of it are scarcely credible. Dr. Russell, in his History of Aleppo, describes a Turk, of the name of Mustapha Shatar, an Opium eater in Symrna, who took daily three drachms of the drug; and even then found a necessity for increasing the dose; and M. Dherc, a French writer, mentions a French officer who took a drachm of it daily. Dr. Pereira* quotes a case recorded by G. V. Zeviane, of a woman of the name of Galvani, who, during thirty-four years, had taken Opium daily to allay the severe pain accompanying the vomiting of urine, which she could not pass in the usual way: she had gradually increased the dose to two hundred grains daily; and, in the period alluded to, she had taken more than two cwt. of solid opium†. Instances have occurred in this country where eighteen ounces of officinal tincture have been taken daily for weeks together! Such individuals sometimes appear in good health; but, in general, they are pale and emaciated; and, in the case of the French officer, an opium eater, an alvine evacuation was procured once only in eight days, sometimes once only in fifteen days. The discontinuance of this habit is extremely difficult‡. In proof of this, Chardin mentions a particularly striking instance of some Turks, Persians, and Arabs, who, having been taken prisoners, were at sea so long that their stock of Opium was exhausted; and, as it could not be replaced, they all became ill, and were sinking one after another into a state of disease; until it occurred to the captain to give them wine, which answered the same purpose. The habitual use of Opium produces a peculiarly depressing influence on the habit: as soon as the excitement it causes is over, a dejection of spirits, almost bordering on despair, follows, and the person becomes more and more wretched, until a judicious renewal of the stimulus is resorted to, when this appears to revive him. Marsden relates that the Malay soldiers, who use Opium to excess, commonly appear emaciated; but, on the other band, the Limen and Batang Assei gold traders, who are an active, laborious class of men, indulge as freely in the use of the drug as the Malay soldiers, and, nevertheless, they are the most healthy and vigorous people in Sumatra§.

This effect of the abuse of Opium must not be confounded with the use of it in extraordinary doses in the treatment of disease. When pain is present, it is truly wonderful to what

* Elements of Mat. Med. vol. i, p. 36.

† Sopra un Vomito Urinco.—Mem. di Maternatica et Fisica della Soc. Ital. Verona, t. vi, p. 93.

‡ The author, many years since, was consulted by a lady, as to the best mode of leaving off the habit of taking laudanum, which she took to a large amount daily. He advised her to get a two-gallon bottle of the tincture, and for every glassful that she took out of it to add a glassful of water: by degrees, it thus would become a bottle of water; and she would overcome, imperceptibly, the use of the opium. She followed the advice for a fortnight, and then relapsed into her old habit.

§ Hist. of Sumatra, 3rd edit. p. 278.

extent it may be administered. I have given, during the passage of gall-stones and of renal calculi, upwards of eight hundred drops of the tincture of Opium in less than twelve hours, without any apparent effect, except that of relieving the excruciating torture under which the patient was suffering. Dr. Chapman mentions an instance in which a wine-glassful of laudanum was taken several times in twenty-four hours, for many months in succession, to alleviate pain in passing biliary calculi; and yet, after the patient was finally recovered, no bad effects whatsoever were perceptible on any of the functions. He also states that Dr. Monges and La Roche of Philadelphia had given it, in a case of cancer of the uterus, to the extent of three pints of laudanum, besides a considerable portion of solid Opium, in twenty-four hours, without any effect except that of relieving pain. It is not easy to account for this effect of Opium on the diseased habit: but the fact is indisputable; and it instructs us how far we may proceed in administering it in cases of disease.

e. Combination also greatly modifies the operation of Opium on the animal system. In combination with antimonials, or with Ipecacuanha, its diaphoretic powers are greatly increased; and it is rendered less likely to impede the other secretions. With acids, half the usual dose will produce the effect of a full dose—a result depending on the production of a soluble salt. When it is intended to procure sleep, Opium should not be combined with *aromatics*, which increase the stimulant effect of the medicine and lessen its soporific influence. It is by combining it with confections and aromatics and syrups that the Turks are enabled to use it as wine. In Persia, in particular, it is taken in this form in society, in the same manner as we take tea and coffee; and, instead of becoming drowsy, those who partake of it become more lively, and often as quarrelsome, as if they had indulged freely in the use of wine.

f. Climate modifies considerably the effects of this narcotic. In those who pass from colder to warmer climates, smaller doses of it are requisite to produce the desired effect than were necessary in the climates from which they have passed. It is supposed also that Opium acts with more energy on some races of men than on others. The Javanese slaves commit the most furious and desperate acts under its influence, not only immolating the objects of their hatred, but also every one who comes in their way. This is what is termed running a *muck*—a practice very common among the Malays. It is not easy to explain this powerful influence of Opium on the Asiatic and Malay races: on the European or Caucassian race it certainly never occurs. Mr. Charvet has attempted to account for it on the supposition that there is a greater comparative quantity of nervous matter in these races than in the European; consequently, that they are more susceptible of impressions on that part of the system: but

this opinion is purely hypothetical. Lastly, certain peculiarities, or idiosyncracy, greatly control the operation of opium. Dr. Christison gives an illustration of this fact. "A gentleman," says he, "of my acquaintance, not accustomed to its use, has taken four hundred and fifty drops of the best laudanum without any other effect than some headache and constipation; and, singularly enough, his son, at the age of six, took 60 minims of solution of muriate of Morphia, without any apparent effect at all*."

Let us next examine the mode in which the salts of Morphia operate. Their influence on man certainly differs from that of Opium in some particulars: these will be noticed after the details of the action of the different salts, which are therapeutically employed.

1. *Acetate of Morphia*, administered in doses of ¼ of a grain to a grain, produces anodyne and soporific effects similar to those caused by opium; but it less frequently affects the head. In doses of a grain, at the end of a short time it produces a slight sensation of fulness in the head, some obscurity of sight, tingling of the ears, cephalalgia, vertigo, a tendency to sighing, and to sleep. The pupils are sometimes dilated, sometimes contracted, but occasionally they are not at all affected: the pulse is not much accelerated: but, after some time, if large doses have been taken, there is a sensation of itching all over the skin; frequently nausea; and a difficulty in passing the urine. These symptoms gradually subside, leaving behind them a slight degree of nausea, and costiveness. In doses of one grain, however, it often neither augments the function of the skin, nor increases its temperature: but in larger doses, it always causes both perspiration and heat of skin. In one instance, where six grains of the Acetate had been swallowed by a medical man, the sweats were so excessive that the patient was forced to change his linen nineteen times in one night. When large doses have been administered, the cerebral excitement is alarming. In the Hôpital de la Pitié, in Paris, where experiments were made with this salt of morphia by M. Bailly†, it was observed that sometimes, after a full dose of Acetate of Morphia, if the patient were in the horizontal position, he was attacked with shocks, as if he had been electrified; the head, in these convulsions, was thrown backwards; and the person, if asleep, was suddenly awoke in a state of surprise. The muscles lost much of their contractile power when the use of the medicine, in such doses, was continued for some time; and tho sight became greatly impaired. There is no diminution of the secretion of the kidneys; but the bladder is paralysed. M. Megraux seems to think that this depends on the action of the salt of Morphia on the brain. It is more probable that the organ itself is primarily affected; as, in one case, this paralysis was

* Christison's Dispensatory, p. 682.

† Mem. de l'Acad. Roy. de Med. t. i, p. 99.

removed by the application of two blisters. In very large doses, Acetate of Morphia acts as a rapid poison. Besides the symptoms already detailed, when Opium operates as a poison, the upper part of the body, when poisonous doses of the Acetate of Morphia has been taken, is often bathed in a viscid sweat, whilst the lower extremities are cold; there are violent nervous shakings; and the body acquires a blue or livid complexion: the face is pinched and exhibits a cadaverous aspect; and death follows without convulsions.

2. The *Citrate*, the *Hydrochlorate*, and the *Sulphate* of *Morphia*, act in a similar manner to the Acetate, except that they do not cause violent sweating, The Hydrochlorate affects the encephalon less than any of the others: its stimulant influence is obscure: its sedative, as well as its hypnotic, very obvious.

In comparing these effects of the salts of Morphia with those of Opium, we are struck with some differences. From salts of Morphia, in moderate doses, we find neither heat of skin, nor elevation of the pulse, nor, except with the Acetate, any sign of the violent propulsion of the blood into the capillaries, as is the case when entire Opium is taken into the stomach. It is of some importance to notice the distinction between the action of *Opium* and that of salts of Morphia; in order that we may be able to accommodate the dose of the remedy to the condition of the habit. Thus, in the cold stage of intermittents, and all cases in which there is a deficiency of blood in the capillaries, Opium in its entire state is to be preferred to the salts of Morphia. The stimulant property of the Opium excites the capillaries, which relieves the internal congestions and brings on sweating as a critical excretion. When full doses of the salts of Morphia have been taken, paralysis of the bladder frequently occurs. The sensations of repose, also, which follow the administration of the salts of Morphia, are less agreeable, and are devoid of the feeling of soft repose which accompanies the soporific action of Opium. The salts of Morphia, when endermically applied, are more anodyne than Opium; but, at the same time that they allay pain, they often, when thus applied, cause an eruption on the skin, very similar to eczema. I have seen it spread over the whole of the body.

3. *Codeia*.—The opinions respecting the narcotic influence of Codeia are very contradictory: Kunkel denies its narcotic properties; whilst Majendie and Barbier contend that it is both anodyne and soporific. The former says that one grain of Cordeia is equivalent to half a grain of Morphia; and that two grains excite nausea and vomiting. He proposes to substitute it for Morphia, for allaying pain and causing sleep, in doses of from one grain to three grains*. It has been used in gastric irritable dyspepsia; and a syrup of it has been employed in

* Formulaire, 8me ed. p. 87.

hooping-cough. It is made with gr. xxiv of Codeia, ℥viii of Sugar, and f℥iv of Water: f℥i has been given for a dose to children of from seven to ten years of age.

4. *Narcotina* is also an active constituent of Opium; but, being little soluble in the animal juices, it does not exert much activity on the living body when administered in the solid form. In solution, the vehicle in which it is administered may bestow some activity on Narcotina; as, for instance, when it is dissolved in *olive oil.* In that vehicle it displays narcotic powers on the systems of some quadrupeds, in particular on that of the dog: but no experiments have yet correctly decided its influence on the human animal, or whether it acts as a stimulant or as a sedative. The experiments of Majendie have led him to conclude that Opium contains both a stimulant and a sedative principle; and he affirms that *Narcotina* is the former: but the effects of the pure salts of morphia on the habit of man completely refutes this position; as both stimulant and sedative effects result from a dose of any of them. When Narcotina is dissolved in water acidulated with weak hydrochloric acid, it may be given to the extent of a drachm for a dose with impunity: M. Bailly, who made numerous experiments with it in the Hôpital de la Pitié, in Paris, remarked that it occasionally produced slight nausea, some disturbance of vision, vertigo, and tremors, with an excitement of the venereal appetite in both sexes. On one occasion, he gave 120 grains to a young man, who experienced only slight vertigo, which soon disappeared. The same effects of Narcotina upon man have been observed by other physicians. In some individuals, however, of a peculiar idiosyncracy, agitation and headache follow its administration. In Bengal, Dr. O'Shaughnessy has employed it successfully as a substitute for Disulphate of Quina, in intermittents. He verified its antiperiodic influence in upwards of two hundred cases.

5. *Meconic acid,* as I have already stated, is perfectly inert: and when Opium has been deprived of all its Morphia and Narcotina, the residue may be given in any quantity without risk. We know nothing of the effects of Narceia and Meconina, and the other salts of Opium, on the animal system; and less of the uncrystallizable constituents, although it has been asserted that the extractive displays narcotic powers: but this may depend upon the affinity of the extractive with the Morphia being so great as to prevent them from being completely separated.

Opium is exhibited both in the *solid* and in the *fluid* form. Let us, therefore, examine the properties of its preparations, in both these states.

EXTRACT OF OPIUM. *Extractum Opii purificatum.* L. *Extractum Opii.* E. *Extractum Opii aquosum.* D.—This is intended to be an extract containing all the soluble principles of opium. The London College directs ℥xx to be acted on by one

gallon of distilled water; the Edinburgh, ℔i by five pints of water; and the Dublin, ℥ii by one pint.

The object of the Extract is to free the opium from impurities.

In prescribing crude Opium, there is one disadvantage—we never can rely on the strength of the specimen, this depending on the season of the year, the soil, the climate, and even the mode of collecting the drug: an Extract is consequently ordered with the intention of obtaining a more definite preparation: but although it is more so than crude opium, yet its activity must vary according to the relative quantity of the Bimeconate in the Opium. The volatile oil, and consequently the odour, of the Opium is dissipated in making the Extract. Good Opium yields from sixty to seventy per cent. of Extract. The dose is from gr. i to gr. iv. In prescribing these Extracts, it is necessary to recollect that their solutions are precipitated by lime water, chloride of barium, nitrate of silver, bichloride of mercury, sulphate of copper, acetates of lead, and all astringent vegetable infusions. An acidulated extract is ordered in the Brunswick Pharmacopœia, which affords a useful mode of exhibiting the Citrate of Morphia in a solid form. It is prepared by dissolving four ounces of Opium in forty-eight ounces of water acidulated with six ounces of lemon-juice, filtering, and evaporating to the consistence of an extract in a water bath. The citric acid in this case decomposes the meconate of Morphia, and affords a more soluble salt, in combination with the gum, and the extractive matter of the Opium. Another useful extract is prepared, according to a process suggested by Deyeux: Opium is fermented with yeast in water, at a temperature favourable to fermentation; and, after the fluid has become clear, it is diluted with more water, and boiled until all odour is dissipated: the solution is then filtered, and evaporated to the consistence of an extract. In this case, the morphia exists in the form of an acetate; and, as several of the other constituents are sacrificed to the formation of the acetic acid by the fermentation, little more remains than the resin, a small portion of the extractive, and acetate of morphia. One grain of this extract is equivalent to gr. iss of the common aqueous extract.

In noticing the extracts, I may mention a preparation called *Chandoo**, which the Chinese make for the purpose of smoking;

* *Method of preparing Chandoo by the Chinese.*—A ball of Patna opium weighing 3lb. 10⅔oz. is divided into two equal parts; the whole of the soft part of the opium is carefully removed from the two sections, and put into a separate vessel; the inner layers are peeled off in shreds, and put into a vessel resembling our skillet, with about a quart of cold water, and boiled. While boiling, the mixture is stirred with a large wooden spatula, without intermission, until the whole is of the consistence of a soft pulp, or smooth paste. The soft opium is then added to the mass, and kept over a brisk fire until it acquire the consistence of extract of opium of the shops. The whole is then removed, equally divided, and spread very evenly on the exterior surface of two

it is a very carefully prepared aqueous extract. The Chinese smoke it in the manner I have already described; and receive from its use a feeling of calm enjoyment which is peculiarly grateful to them. I am much disposed to think it might prove useful in affections of the lungs; for instance, spasmodic asthma, and, perhaps, even phthisis.

Crude Opium is a constituent of the following preparations:

Troschisci Opii, E.; each lozenge contains abont $\frac{1}{4}$ of a grain of opium.

Pulris Cretæ comp. cum opio, L. D.; dose, gr. v to gr. xl; contains gr. i of opium in gr. xl (L.); gr. i in gr. xxxvi (D.).

Pulris Cretæ Opiatus. E.; dose, gr. v to gr. xx; contains gr. i of opium in gr. xxxvii.

——— *Kino comp.* L. D.; dose, gr. v to ℈i; contains gr. i of opium in gr. xx.

——— *Ipecac. comp.* L. E. D.; dose, gr. v. to ℈i; contains gr. i of opium in gr. x.

In the first two of these preparations the power of the Opium is greatly weakened by the chemical action of the chalk, and in the third by that of the kino upon the bimeconate of morphia. Vogler has proposed a substitute for the compound powder of ipecacuanha, which might be advantageously introduced into the British Pharmacopœias, for some particular cases, as a convenient mode of giving a combination of opium and ipecacuanha in children's diseases. He orders gr. i of ipecacuanha, gr. ii of opium, ʒi of nitre, ʒi of bitartrate of potassa, f℥iv of water of accacia flowers, and fʒiv of the syrup of the red poppy. I have been in the habit of prescribing a mixture containing fʒii of ipecacuanha wine, and of tincture of opium, ʒiss of nitrate of potassa, fʒiv of lemon juice, and f℥iv of camphor mixture, instead of Dover's powder. Two table-spoonfuls of this mixture are equal to gr. x of Dover's powder: it operates more certainly as a diaphoretic than that medicine.

The *Pilulæ Styracis compositæ*, L. *Pilulæ cum Styrace*, D. contain $\frac{1}{5}$, *Pilulæ Styracis*, E. $\frac{1}{4}$ of opium; the dose is gr. iii to gr. x.

Pilulæ Saponis compositæ, L. *Pil. Saponis cum opio*, D. contains $\frac{1}{5}$ of opium; its dose is gr. iii to gr. x.

Pilulæ Ipecacuanhæ compositæ, L. contains $\frac{1}{18}$ of opium; dose, gr. v. to gr. x.

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shallow vessels, which are inverted over a *very gentle fire*, for the purpose of evaporating it to dryness (this part of the process would probably be better conducted in an oven); when sufficiently dry, the whole mass is reduced to powder. The powdered ingredient is then mixed with repeated portions of filtered boiling water, until the fluid pass through colourless; after which, it is filtered and again evaporated with the aid of a brisk coal fire, in a deep copper vessel, to the consistence of good treacle. This very pure extract has a smooth, uniform appearance, like a transparent jelly, with a sweetish and rather agreeable odour, resembling soft extract of gentian. The whole process being gone through, it should yield one pound twelve grains and six drachms, or very nearly 50 per cent. of the original weight of the opium employed.

Pilulæ Calomelanos et Opii, E.; dose, one to two pills, each pill containing $\frac{2}{5}$ of a grain of opium.

Pilulæ Opii sive Thebaicæ, E. —— $\frac{1}{5}$ of opium; dose, gr. v to gr. x.

Pilulæ Plumbi Opiatæ, E.; dose, one to three pills, each pill containing gr. ss of opium.

Some of these pills should have been left to the discretion of the practitioner, as many circumstances demand both a different proportion of opium and a different combination of it.

The *Electuarium Catechu*, E. gr. x contain $\frac{1}{7}$ of a grain of opium. *Elect. Catechu comp.* D. ℥i contains gr. iiss of opium; dose, ℈i to ʒi.

Confectio Opii, L. gr. xxxvi contain gr. i of opium; its dose is gr. x to ʒss.

Electuarium Opii, E. D. xliii (E.) contain gr. i; gr. xxv (D.) gr. i of opium; dose, ℈i to ℈iiss.

Nothing can be more injudicious than the usual method of prescribing the Confection of opium with astringent mixtures; the Morphia being thrown down, so that the mixture remains nearly a compound of aromatics and astringent matter; without possessing any Narcotic influence, unless it be shaken up each time a dose is taken.

The *Tinctura Opii*, L. E. D. contains $\frac{1}{19}$ L., $\frac{1}{13\frac{1}{2}}$ E., $\frac{1}{15}$ D., of opium; its dose is m. xix to fʒss, L.; m. xiv to m. xxviii, E.; m. xiii to m. xxvi, D.

——— *Opii Ammoniata*, E. $\frac{1}{73}$; dose, fʒi.

No preparation displays less chemical knowledge than the Ammoniated Tincture: instead of the full proportion of Morphia in the quantity of Opium employed, the preparation contains only as much as a weak spirit, aided by ammonia, can take up; and, as the ammonia is dissipated every time the bottle containing the tincture is opened, the Morphia after a time is thrown down.

The *Tinctura Camphoræ composita*, L. *Tinct. Opii, Camphorata*, E. D. contains gr. ii. of opium in f℥i of the tincture; its dose is fʒi to fʒiv.

Vinum Opii. L. E. D. The London preparation in fʒi contains gr. iii of opium. The cinnamon and cloves are bad additions, as they partially decompose the Bimeconate of Morphia: but were the oil of Cinnamon and of Cloves used instead of the Cinnamon and the Cloves, the preparation would be valuable in cases in which a combination of stimulants and Narcotics is indicated. The usual dose is from m. x to fʒi.

Laudanum Liquidum Sydenhami, is the original of the Vinum Opii, with double the quantity of opium. One fluid drachm contains ten grains of Opium: under all circumstances, it is preferable to the Vinum Opii of the present Pharmacopœias.

Vinegar of Opium.—*Acetum Opii*. E. D. In this preparation, which is made by macerating ℥iv of opium, triturated

to a pulp, in f℥xvi of distilled vinegar, the Bimeconate of Morphia is decomposed and the Acetate formed. It possesses more activity than an aqueous solution of opium of the same strength, especially in reference to its anodyne influence. Dr. Montgomery* and some other physicians have observed a paralyzing effect on the bladder of urine when it has been taken. It does not cause the constipation which is the result of other preparations of opium. It contains one fifth of opium. The dose is m. vi to m. vii.

Black Drop.—This preparation, which is intended to be superseded by the Acetum Opii, was made upwards of one hundred years since, by Edward Runstall, of Bishop Aukland, in the county of Durham. It has been stated by the late Dr. Armstrong and others, that it is prepared by slicing half a pound of Opium, and boiling it, in conjunction with an ounce and a half of nutmegs and half an ounce of saffron, in four pounds of verjuice; then adding a quarter of a pound of sugar and two table-spoonfuls of yeast. This compound is allowed to ferment for six weeks in a warm place; after which it is decanted, filtered, and bottled, adding a little sugar to each bottle. Were this recipe correct, it is evident that the black drop would contain an acidulous acetate of Morphia: it is affected by most of the usual tests of the tinctures, and other preparations of Opium; and indicates the presence of Morphia when tested by nitric acid. The nature of this preparation is, however, yet unknown: it is much more powerful as a narcotic than the officinal tincture, three minims of which are only equal to one minim of the Black Drop.

Battley's Sedative Solution.—I am inclined to believe that this preparation contains some acetate besides bimeconate of Morphia; but this opinion is merely conjectural, as the preparation is kept secret. It does not exceed the officinal tincture in strength, and it has no advantage over it, except that it is less stimulant.

Liniment of Opium. *Linimentum Opii*, L. E. *Linimentum Saponis cum Opio*, D., although it possesses no advantage over the extemporaneous addition of Tincture of Opium to the soap liniment, yet is a useful external application.

Enema of Opium. *Enema Opii.* L. E. D.—This is an unnecessary formula, as many circumstances demand that the proportion of opium should be different from that of the Pharmacopœias.

Compound Ointment of Galls. *Unguentum Gallæ compositum.* L. E.

Decoction of Poppies. *Decoctum Papaveris.* L. E. D.—(See p. 405.)

* Observ. on the Dub. Pharm. p. 451.

Extract of Poppies, *Extractum Papaveris*, L. E. is merely an inferior preparation of the gummy extract of opium, prepared from a decoction of the capsules of the poppy. Dose, gr. ii to ℈i.

Syrup of Poppies, *Syrupus Papaveris albi*, L. E. D. is a bad preparation, owing to the uncertainty of its strength. It acquires more active properties when it ferments. Dose, f℥ii to f℥iv.

Salts of Morphia.—Of all these, the Hydrochlorate, in my opinion, is the best, and the most certain in its action. All the salts may be extemporaneously formed. Thus, by adding the common tincture of opium to mixtures containing either the sulphuric, hydrochloric, nitric, tartaric, acetic, or citric acid, we obtain the sulphate, hydrochlorate, nitrate, bitartrate, tartrate, acetate, or citrate of Morphia. In employing the ready-formed salts, it is necessary, in adding other saline constituents, to be aware of those which are likely to decompose the salt employed. If, for instance, we wish to combine a salt of baryta with a salt of Morphia, we must adopt the hydrochlorate, and avoid employing the sulphate; if with the nitrate of silver, the hydrochlorate must not be selected. We may prescribe the citrate with lime-water.

Many of these salts have been employed in their impure state, in the form of tincture: thus, as I have already remarked, Battley's Sedative Solution may be regarded as an impure acetate and bimeconate of Morphia in solution. A citrated tincture has also been employed from a suggestion of Mr. Potter, of Bristol; and I suggested a tincture of the impure hydrochlorate, which has the advantage of containing no narcotina, and may be combined with many of the alkaline and some of the metallic salts, without suffering decomposition.

Hydrochlorate of Morphia is contained in the following preparations:

Trochisci Morphiæ, E.; each lozenge contains about gr. $\frac{1}{9}$ of opium.

Trochisci Morphiæ et Ipecacuanhæ, E.; each lozenge contains gr. $\frac{1}{9}$ of opium.

Such are the various preparations of Opium. Some of them are most unchemical, and defeat the object for which they are intended, and ought to be rejected from the Pharmacopœias.

b. Atropia is an alkaloid, the active principle of *Atropa Belladonna.*

Deadly Nightshade. *Belladonna.* L. E. *Atropa Belladonna, folia et radix.* D.—Deadly Nightshade is an indigenous plant, which flowers in June, and ripens its seed in September: belonging to the natural order Solanaceæ*. The root, which is perennial, is fleshy and creeping; and throws up herbaceous

* Woodville's Med. Bot. 3rd edit. p. 230, pl. 52. Richard, Hist. Nat. Med. t. ii, p. 84. Lindley, 572. Hayne, i, 43. The generic name is derived from Atropa, one of the Fates Dr. Paris informs us that the specific name Belladonna originates from the Italian ladies using the fruit to render their faces pale, as an aid to beauty.

annual, round, branched, slightly downy stems, rising from three to four feet in height, and thickly covered with leaves of unequal size, in pairs, ovate, acute, entire, and exhaling when bruised a fetid odour. The flowers are axillary, solitary, campanulate, of a dull-purplish or lurid hue; and the fruit a violet-black shining berry, imbeded in the calyx, about the size of a small cherry, and sweetish to the taste.

The *roots* of Belladonna should be collected in autumn, or in early spring: when recent, they are fleshy, branching, externally grayish, internally white, nearly inodorous, and impress a sweetish taste on the palate. The *leaves* should bo collected when the plant is in flower, and carefully dried: they have a bitterish, acidulous taste. Brandes found, in the leaves of Belladonna, *Supermalate of Atropia, Pseudo-toxin**, *Phytocolla, wax, gum, starch, albumen, chlorophylle, some salts, and lignin;* to which, Luebekind added a new volatile alkali, which he named *Belladonnin*†; and Richter a new volatile, crystallizable acid, which he has termed *Atropic acid*‡. The most important of these principles is Atropia.

Atropia was discovered by Brandes, and obtained from the leaves of Belladonna; but Mein and Richter procured it from the roots. The following is Brandes's process. Bruise the leaves of the mature plant, and boil them in water acidulated with sulphuric acid, then filter the decoction, and precipitate with potassa. After washing the precipitate, treat it with sulphuric acid, and again precipitate with potassa. The product, being collected on a filter, well washed and dried, is to be submitted to the action of boiling alcohol: the spontaneous evaporation of the filtered alcoholic solution furnishes pure Atropia§. M. Runge also prepared Atropia, by pouring on a solution of sulphate of magnesia just enough of the solution of potassa to decompose the sulphate, and to form a hydrate of magnesia mixed with a sulphate of potassa and magnesia, to which he added extract of Belladonna mixed with water. He then evaporated the mixture to dryness, and, having reduced it to powder, he treated it with boiling strong alcohol, which, by spontaneous evaporation, yielded the Atropia.

Prior to the discovery of Atropia by M. Brandes, Belladonna had been examined by M. Melandri and M. Vauquelin. Melandri discovered in the leaves of Belladonna a soft green resin, an animal extractive, mucus and extractive, besides binoxalate of magnesia, oxalate of lime, and chloride of potassium. In the berries he found a colouring matter, a sensible test of acids and alkalies‖. Vauquelin obtained from the juice of the plant an azotized mat-

* A brownish-yellow substance, soluble in water, but insoluble in alcohol and ether.

† Belladonnin is crystallizable, has an ammoniacal odour, and, when swallowed in doses of two or more grains, causes heat of the throat and constriction of the larynx, Pharm Cent. Blatt für 1839, § 448.

‡ Ibid. § 614.

§ Gmelin's Handb. der Chem. ii, 1805.

‖ Ann. de Chim. lxv, 222.

ter, which partly coagulated by heat and partly remained in solution, owing to the presence of some free acetic acid—a bitter, nauseous matter, which, in combination with tannic acid, became insoluble, and yielded ammonia by destructive distillation; nitrate, muriate, sulphate, binoxalate, and acetate of potassa*. M. Brandes' analysis followed that of Vauquelin; and, after Brandes', M. Peschier of Geneva examined the plant. Besides the alkaloid, he procured an acid which retained the phosphate of lime in solution.

Atropia is procured in silky, acicular crystals, white and shining. It is inodorous and bitter; scarcely soluble in water or in cold alcohol, but soluble in boiling alcohol. At a temperature of 212° it is volatilized, and deposited like a coat of varnish. It is precipitated from its solution by infusion of galls, by yellow cinchona bark, and by the chlorides of platinum and of gold. According to Leibig, it is a compound of C. 34, H. 23, N. 1, O. 6, equiv. = 293·23. It unites with acids and forms crystallizable salts.

According to M. Brandes, the composition of the sulphate is Atropia 38·93, + Sulphuric Acid 36·52, + Water 24·55, = 100·00. That of the Hydrochlorate, 39·2 of Atropia, + 35·4 of Acid, + 25·4 of Water, = 100·0. The Sulphate forms beautiful crystals†.

The poisonous qualities of the berries of Belladonna have been long known. Buchanan, the Scottish historian, ascribes the victory of Macbeth over the Danes to the infusion of these berries in some ale and wine sent to Sweno during a truce. "Vis fructui," he adds, "radici ac maxime semini somnifera, et quæ in amentiam si largius sumantur." The intoxicating effects of the root of the plant seems also to have been formerly well known‡. The symptoms of intoxication are accompanied with fits of laughter and violent gestures: these are followed by a low and feeble pulse, paralysis of the intestines, imposthotonos§, convulsions, and death. Dissection demonstrates that the stomach and intestines have been inflamed: the most rapid decomposition of the body takes place after death.

The first effects of Belladonna are fever, accompanied with *dryness* of the throat, difficult deglutition, mania, and thirst; which are followed by vertigo, dilatation of the pupils, dimness of the sight, suffused eyes, and visual illusions; tinnitus aurium, numbness of the face, vertigo, extravagant delirium, resembling intoxication, sopor, and an eruption over the skin closely resembling that of scarlatina. The pulse is usually small, but hurried. These symptoms occur when the extract of Balladonna is ap-

* Ann. de Chim. lxxii, 53. † Journ. de Pharm. vi, p. 548.

‡ In the tragedy of Macbeth, when the Witches vanish, Banquo is made to remark—
Have we eaten of the *insane* root
That takes the reason prisoner?

§ A spasmodic flexion of the body forwards.

plied to an abraded surface, and even in a minor degree when it is rubbed on the sound skin. When applied to the eyebrows, it acts on the radiated fibres of the iris, dilates the pupil, and maintains the dilatation for some considerable time. No more decisive demonstration of the direct influence of Belladonna on the nerves could be expected. The pupil only of the eye, to the eyebrow of which the extract is applied, is affected, although it is well known that there is a consentaneous action in both eyes in the normal condition of the ciliary nerves, on which it is probable that the topical influence of the narcotic is exerted. The influence on one eye only could not take place were the extract absorbed, owing to the tendency to associate in action of the two motores oculi, from which the ciliary nerves are supplied*. Its property as an anodyne is rendered obvious by the relief which it affords when the powder of the leaves is sprinkled on open, painful cancer, or the extract rubbed upon the perineum in chordæ. Upon the whole, the most striking characteristics of the action of Belladonna are the following: dilatation of the pupils, disturbed vision, vertigo, and gay, extravagant delirium, succeeded by sopor.

An overdose of Belladonna produces all the symptoms already described in an imminent degree; dilatation of the pupil, blindness, or confused vision, suffusion of the conjunctiva, protrusion of the eye, with a dull pain in it, dryness of the mouth and throat, impeded deglutition, and such an effect on the stomach, that it cannot be excited to vomiting by any emetics. After a while, the brain displays the extent to which it is affected, by vacuity of countenance, often with gay delirium. In such cases, the advantage of the stomach pump is great. After the stomach has been emptied, vinegar is said to be the best antidote; but, previous to the use of the vinegar, I would recommend the administration of alkalies, or the tincture of the infusion of galls, to decompose the malate of Atropia which may yet remain in the stomach: and it is not until the whole of this is evacuated that vinegar ought to be given. The cold affusion on the head and body is superior to all other means.

The preparations of Belladonna in the British Pharmacopœias are an Extract and a Plaster. A *Tincture* has been used on the Continent, and even by some practitioners in this country. It may be prepared either with ℥ii of the leaves, or with ʒx of the extract and a pound of proof spirit, macerating for fourteen days and filtering. The dose of the former is m. xx to xl; of the latter, m. ii to m. iii; gradually increased until its influence becomes evident. Much, however, must depend on the goodness of the extract.

The Extract† is the simple inspissated expressed juice; it

* Muller's Phy. Trans. by Bally, i, p. 736.

† Extractum Belladonnæ. L. E. Succus Spissatus. D.

is very variable in its strength, and, therefore, requires to be commenced in small doses, namely, a grain; and the dose gradually increased, until it displays very obvious symptoms that the constitution cannot bear a higher dose. It is sometimes topically used, in the form of a plaster, in neuralgic pains, and for smearing bougies in spasmodic strictures of the urethra; and also as an application to painful hæmorrhoids.

The officinal PLASTER* is a compound of the Extract and Resin, or of Soap-plaster. Its anodyne property is destroyed, if too much heat be used in its preparation, or in spreading it on leather.

c. DATURIA.—This is an Alkaloid, the active principle of the Datura *Stramonium*, a plant belonging to the natural order Solanaceæ, a native of tropical Asia, but now naturalized to our soil†.

LEAVES AND SEEDS OF STRAMONIUM. *Stramonii folia semina.* L. D. *Stramonium.* E.

The Stramonium is an herbaceous, leafy, spreading, dichotomus annual, rising from two to three feet in height; with large, ovate, variously and acutely sinuated, veined, soft, dull-green coloured leaves; and axillary, long, trumpet-shaped, white flowers, which diffuse an agreeable odour at night. The fruit is a large prickly capsule, four-celled, opening with longitudinal valves, and filled with numerous, reniform, flat, brownish-black seeds.

The whole plant has a strong narcotic odour and a bitter nauseous, mawkish taste, imparting a green tinge to the saliva when it is chewed. All the plant is medicinal, as well as the leaves. It should be gathered when in full flower; and the seeds when they are ripe. The leaves lose their odour, but retain their taste, in drying. Stramonium yields its active properties to water, alcohol, and fixed oil: they depend on *Daturia*, which is found in combination with malic acid, in the seeds and the leaves. It is procured by macerating the seeds in boiling rectified spirit of wine, decomposing the malate thus taken up by magnesia, and again treating the precipitate with alcohol, which by evaporation deposites the Daturia, in colourless, brilliant prisms, that are almost insoluble in water, in ether, and in cold alcohol, but very soluble in boiling alcohol. It forms crystallizable salts when united with acids; is inodorous, has a bitter taste, somewhat resembling tobacco; and is volatilized by heat.

Daturia was discovered by M. Brandes, and is justly regarded as the active, narcotic principle of Stramonium. Wedenberg found that, besides the Daturia, Stramonium contains mucus, resin, and a small proportion of a volatile matter. I have ascer-

* Emphlastrum Belladonnæ. L. E. D.

† Woodville's Med. Bot. 3rd edit. p. 197, pl. 74. London Dispensatory, art. Datura. Richard, Hist. Nat. Med. t. ii, p. 107. Lindley, 510. Hayne, iv, 7. Gerard claims the merit of introducing Stramonium into England, about the close of the sixteenth century.

tained that the volatile matter is carbonate of ammonia, and that the leaves also contain a small proportion of tannic acid. In a more recent analysis, Promnitz found, in 100 parts of Stramonium, 0·60 of extractive, containing Daturia, 0·58 of gummy extractive, 0·64 of chlorophylle, 0·15 of albumen, 0·12 of resin, 0·23 of phosphate of lime and magnesia, 5·15 of lignin or woody matter, and 92·53 of water.

The narcotic properties of some of the species of Daturia* have been long known in the East; and most of them have been smoked in Ceylon to relieve asthma. Stramonium seems also to have been smoked in Europe prior to 1542, as Fuchs informs us that its vernacular name in Germany was *Rauchapfelkraut*, Smoke-applewort†. The poorer Turks use Stramonium instead of opium, and the Chinese and the Russians infuse it in beer, to produce intoxication. In the Carnatic, the native practitioners use the Datura in all painful affections, even in cancer. The Arabians were early acquainted with its narcotic powers, and employed it both as a poison and as a medicine. Its influence on the animal system so closely resembles that of Belladonna, that it is scarcely necessary to enter into details. Indeed, so closely does it resemble Belladonna, that even, in the intoxication which it produces, the same follies are committed. In some parts of Europe, this effect is so well known, that the plant is vulgarly called "Herbe aux Sorciers."

Stramonium is administered in the forms of Powder, Extract, and Tincture. The Extract only is officinal.

Extract of Stramonium, *Extractum Stramonii*, L. E. D. varies according to the mode of preparation, and therefore it is an uncertain medicine. The London and the Dublin Colleges order an aqueous Extract of the seeds; the Edinburgh, a spirituous, consequently a more active preparation: the dose is from one fourth of a grain to a grain; but it may be gradually augmented to five grains: if well prepared, it should not exceed half a grain at first. The dose of the powdered herb, or of the seeds, is gr. i to gr. v. I have found the tincture of the seeds a valuable Narcotic. It is made with ℥ii of the bruised seeds digested in f℥xvi of alcohol for six days, and filtered, or passed through the percolator. The dose is from m. x to m. xx. M. Kirchoff, a French surgeon, states that, by rubbing this tincture on the part affected fifteen times a day and continuing it for some time after the pain is relieved, he has completely cured the most painful neuralgia. The same practitioner, and Dr. Englehart of Utrecht, have found it efficacious in all the cases in which Belladonna is useful. Daturia is too active to be internally administered. When the herb is smoked in the same manner as tobacco, it exhales an empy-

* D. *tatula*, D. *ferox*, D. *fastuosa*, D. *Metel*, and D. *arborea*; all of which possess properties similar to Stramonium.

† Christison's Dispensatory, p. 891.

reumatic oil in combination with daturia, and operates as a powerful narcotic. The dose is gr. x to ʒss.

In overdoses, Stramonium operates as a poison. I witnessed the effects of the seeds in a child of Dr. Duffin, who had eaten a considerable number of the seeds. The symptoms were a flushed face, dilated pupils, loss of voice, delirium, a small but regular pulse, which became rapid during the continuance of the coma, which supervened. Death occurred twenty-four hours after swallowing the seeds. There did not, in this case, appear to be much determination to the head; yet, when death ensues, the post-mortem examination usually displays congestion of the brain; and, in a case recorded by Haller, extravasation into the ventricles had taken place. When recovery occurs, a very troublesome itching remains for some time after the effects of the poison are subdued. Daturia is a most virulent poison.

d. Nicotina, the alkaline principle on which the narcotic and sedative property of Tobacco depends, has already been described (p. 308). When the Infusion of Tobacco is administered, in large doses, it operates as a powerful narcotic; but its action is attended with some risk; and, therefore, it is seldom prescribed.

e. Hyosciamia.—This is an alkaloid, the active principle of Henbane, Hyoscyamus *niger**, an indigenous annual, belonging to the natural order Solanaceæ. The officinal parts of the plant are the leaves and the seeds.

Leaves of Henbane. *Hyoscyami folia.* L. D. *Hyoscyamus.* E. Seeds of Henbane. *Hyoscyami semina.* D.

The plant grows on waste ground, flowering in July. It bears leaves only in the first year; but, in the second, it shoots up a spike, composed of dingy, yellowish flowers, beautifully reticulated with purple lines on one side of the spike, which on the other bears viscous, leafy bractes in pairs. The seeds, which are small, reniform, and flattened, are contained in a bilocular capsule, opening by means of a circumcised lid. The seeds ripen from August to October. All the parts of the plant have an offensive, fetid odour, a clammy, slightly adhesive feel, and an appearance indicative of its poisonous character. The wild plant is preferable to the cultivated. The leaves should be collected when the first flowers of the spike are opened, and dried rapidly between folds of bibulous paper. If they are intended to form the Extract, the juice should be expressed as soon as they are collected. The taste of the leaves is mucilaginous and slightly acrid, causing heat in the throat, nausea, a hot skin, an accelerated pulse, a tendency to sleep, headache, vertigo, and dilated pupils.

* Woodville's Medical Botany, third edition, p. 204, p. 73. London Dispensatory, art. Hyoscyamus. Richard, Hist. Nat. Med. t. ii, p. 98. Lindley, 508. Hayne, i, 28. Ὑοσκυαμος, Dioscorides.

The active principles of the plant are taken up both by water and alcohol: decoction destroys them. The infusion, which is not officinal, is not affected by diluted acids: the alkalies change its colour to deep greenish-yellow; it is copiously precipitated by diacetate of lead, nitrate of silver, and sulphate of iron. Several chemists have analysed Henbane. M. Peschier obtained from it, in addition to hyoscyamia, a crystallizable acid resembling wax, and phosphate and carbonate of lime*. By precipitating an infusion of the seeds of Henbane by means of an alkali, M. Brandes obtained the peculiar principle now under consideration, *Hyoscyamia*, in the form of an oleaginous fluid, *arabin, bassorin, fecula, albumen, phyteumacol,* and *fixed oil.* Geiger and Hesse procured the Hyoscyamia in oblong crystals or prisms, which form neutral crystallizable salts with nitric and sulphuric acids. It is soluble in alcohol and ether, but sparingly in water, affording an alkaline reaction, and is precipitated from its solution by infusion of galls. The crystals are volatilized by heat without decomposition: but they are decomposed when boiled in the pure alkalies, evolving ammonia. Hyoscyamia is inodorous, and has an acrid nauseous taste. It may be readily procured by making an alcoholic extract of the seeds, dissolving it and decomposing by means of carbonate of soda in excess. The alkaline fluid is to be concentrated and expressed, and the residue treated separately with alcohol and ether. The mixed etherial alcoholic solution is next to be digested with animal charcoal, and then filtered and evaporated. The Hyoscyamia crystallizes in an impure state; but it may be purified by repeating the whole of the process after the use of the carbonate of soda†. It is found, also, in the root and the leaves, but in less quantity than in the seeds. M. Planché procured an extract from the dried plant, by macerating one part of it in four parts of alcohol, for four days, filtering the tincture and evaporating to dryness in a water bath: it had a beautiful green colour, retained all the virtues of the plant, and probably contained the active principle.

With respect to the physiological influence of Henbane, it is regarded as a Narcotic, analogous to opium in its effects. It operates directly on the nervous system, invigorating the pulse, producing an increased heat of the skin; and, after these effects have subsided, inducing sleep. It does not confine the bowels, neither does it affect the head so much as opium. In large doses, however, it acts as a virulent poison; causing, in the first instance, sickness, stupor, dimness of sight, hard pulse, delirium, coma, and dilatation of the pupils; afterwards, weakness, tremulous pulse, cold sweats, petechiæ, and frequently death. One effect of an overdose is singular: sometimes, the sense of sight seems for a few moments lost; again, objects appear much

* Biblioth. Univers. Sept. 1820.

† Ann. der Pharm. vii.

larger or much smaller than natural, more distinct or nearer, or they seem to move, dance, or fall, or they appear wrapt in a cloud, or of ever-varying colours. In some habits it excites a pustular eruption on the skin.

The ancients were acquainted with the narcotic powers of Henbane: Störck investigated its effects, and established its use as a Narcotic. But, under all circumstances, the narcotic powers of Henbane are inferior to those of opium or of the salts of morphia. Smoking the leaves in the manner of tobacco, allays pain and resolves spasm. When applied to the surface, the Extract also diminishes pain and dilates the pupil. It, therefore, possesses anodyne as well as narcotic powers.

TINCTURE OF HENBANE, *Tinctura Hyoscyamia*, L. E. D. is the best form of exhibiting Henbane. It is made with five ounces of the dried leaves, and two pints of proof spirit. The Edinburgh College employs the percolator; the London and and Dublin Colleges, maceration. The dose is m. xxx to f℥ss.

EXTRACT OF HENBANE. *Extractum Hyoscyami*, L. E. D. *Succus Spissatus Hyoscyami*, D. Much depends on the goodness of the Extract. The dose is from gr. iii to gr. xvi; but it has been gradually carried to gr. lx. It should not be prescribed in combination with alkalies, nor with lime water, as these destroy its narcotic power. As a cataplasm, the leaves in powder may be steeped in boiling water and mixed with bread crumbs.

Fatal cases of poisoning by Henbane and its preparations exhibit, on dissection, inflamed and gangrenous spots on the inner surface of the stomach, with a gorged state of the vessels of the brain. Vinegar has been recommended as an antidote; but, from the action of the alkalies, I should feel disposed to place more confidence on them: the first step, however, is to evacuate the stomach; after which, the habit may be roused by ammonia and cordials.

Hyoscyamia operates in the same manner as the Extract of the leaves, but more energetically: it is a powerful narcotic poison; and the same may be said of the empyreumatic oil.

f. ACONITINA, L. is alkaloid, the active principle of all the species of the genus Aconitum. Many of the species are poisonous; the most so is the Aconitum *ferox**. The genus belongs to the natural order Ranunculaceæ†.

LEAVES OF ACONITE. *Aconiti folia.* L. D. *Aconiti radix.* L. *Aconitum.* E.—The London and the Dublin Colleges regard the Aconitum *paniculatum*, the Edinburgh, the Aconitum *Napellus*, as the officinal plants. Störck, who introduced the Aconite into

* A species figured by my friend Dr. Wallich, in his splendid work Plantæ Rariores Asiaticæ. It is used often by the natives of India to poison tanks of water, to check the progress of an army. This attempt, says Dr. Wallich, was actually made, in the Nepal war, at Hotouura; but it was discovered in time to save the soldiers. It is also used for poisoning arrows.

† Woodville's Med. Bot third edit. p. 461, pl. 165. Lond. Dispen. art. Aconitum. Richard, Hist. Nat. Med. ii, p. 595. Lindley, ix. Hayne, xii, 15.

medical practice in 1762, named the plant used by him A. *Napellus*. It is, however, doubtful whether Störck's plant was not a variety of A. *Cammarum*, which Sprengel termed *Stoerckianum*, and De Candolle has named *paniculatum*. On the authority of the last-named botanist, the London College has adopted the *paniculatum* as the officinal plant; whilst the Edinburgh College has been induced, probably by the circumstance of the A. *Napellus* being the species most commonly cultivated in this country, to retain it. It is a question of little moment, as most of the species contain Aconitina, and are powerful Narcotics.

Both the A. *paniculatum* and A. *Napellus*, have a napiform, fibrous root, and leaves divided in three lobes, nearly down to the footstalk, the segments wedged-shaped, and the lateral ones two-parted; the segments are also deeply pinnatifid and slashed, of a dark-green colour on the upper surface and pale beneath. The *paniculatum* is distinguished by its erect, lax, corymbose panicle, of smooth *pale* blue flowers; whereas the *Napellus* bears a simple cylindrical raceme, of deep, purple, hairy flowers. The helmet in the former is convex and more accuminate than in the latter. The root and the leaves of both species are inodorous; the leaves of *paniculatum* have little acrimony; those of *Napellus*, when plucked before the plant is in seed, impress a tingling, followed by numbness, on the tongue and lips. Both the roots and the leaves of each species suffer no change in their properties by drying. The expressed juice possesses the narcotic properties of the plant.

Aconitina was first discovered by Geiger and Hesse, in 1833. It is procured by making an extract of a decoction of the bruised root in rectified spirit, redissolving it in water, and, after concentration, adding as much sulphuric acid, diluted with water, as will dissolve the Aconitina, and decomposing the sulphate with ammonia. By repeating the formation of the sulphate, colouring with animal charcoal, and again decomposing it, the Aconitina is produced. It is a white, inodorous powder, bitter to the taste, easily fused, not volatile, scarcely soluble in water, but soluble in alcohol and in ether. It displays an alkaline reaction, and unites with acids; but its salts are not crystallizable. It is combined in the plant with a peculiar acid, detected by Buchner and named *Aconitic*, the constituents of which are C. 4, H. 1, O. 3*. The ultimate composition of Aconitina is undetermined.

A spurious Aconitina has been lately imported from France; it is readily distinguished by its little solubility in alcohol and ether, and by leaving a calcareous residue when burnt on platinum foil†.

The whole of the genus Aconitum is poisonous‡. The root

* Pharm. Centr. Blatt. für 1838.

† The best Aconitina is that made by Mr. Morson of Southampton Row.

‡ It is curious to trace the fables of the ancients in reference to this quality of the Aconite. Ovid relates that when Hercules descended into hell to recover Alcestes, he

is the most poisonous part of the plant. The dried leaves powdered have at first a sweetish taste, which, however, is soon followed by an acrid, burning sensation, accompanied with profuse salivation; and, if the Extract be given without the greatest caution, it acts at first on the stomach, then on the nervous system, producing vomiting, hypercatharsis, vertigo, cold sweats, delirium, and convulsions, which terminate in death. Dr. Pereira found that a few grains of the alcoholic Extract, introduced into the cellular tissue beneath the skin, will kill a small animal in ten or fifteen minutes. If it be placed on the eyelids, it causes tears to flow; but it produced no sensation of heat: and when the powder is sprinkled upon an ulcer, it causes neither heat nor pain. It resembles strychnia in its effects on the posterior extremities, when it is administered to quadrupeds. Post-mortem dissections display few evidences of local inflammation. The poisonous effects of Aconite were confirmed on a large scale by the experiments made with it upon condemned criminals at Prague, by order of the Emperor Ferdinand I; and also at Rome, under Pope Clement VII. If it be overdosed, after emptying the stomach, either by the stomach-pump or by emetics, coffee, and powerful stimulants, namely, brandy and ammonia, should be administered, and blisters applied over the stomach.

The only officinal preparation of this plant in the British Pharmacopœias is ACONITINA and the INSPISSATED JUICE; on the Continent, a Tincture and Wine of the seeds are used, and regarded as not only more certain in their doses, but much better adapted for conveying the influence of this Narcotic into the habit, than the Inspissated Juice. Dr. Turnbull*, also, employs a Tincture made with one pound of the recently dried root, pulverized, and one pound and a half of rectified spirit. The dose is five drops, given three times a day; but its administration requires caution. He also employs the Tincture as a topical remedy in neuralgia and rheumatism, applied with a sponge tied to a stick. By evaporating this tincture, a powerful extract is obtained, which may be given internally, in doses of one sixth of a grain; and, rubbed up with two parts of lard, it may be used as a topical anodyne.

EXTRACT OF ACONITE, *Aconiti Extractum*, L. E. *Aconiti Succus spissatus*, D. are variable and uncertain preparations, sometimes acting powerfully, at other times very feebly. The usual dose of the extract, or inspissated juice, is from one to two grains, gradually augmented until it displays a marked effect on the habit.

ACONITINA, L. has only been endermically employed; the

left upon the ground, when he returned, a scum which engendered the plant. It was the principal ingredient in the poisonous cup that Medea prepared for Theseus; and it was the poison employed to execute the barbarous law in the Island of Ceos, which condemned to death all who were no longer useful to the state: hence the old men, who had become useless, were presented with a draught of the juice of Aconite.

* Treatise on Painful and Nervous Diseases, 8vo 1807, p. 91.

quantity used at a time should not exceed, at first, one sixteenth of a grain: it can seldom be carried beyond one fourth of a grain. In every form of preparation it is a medicine of extreme virulence, and requiring the utmost caution in its administration.

g. Colchicia, an alkaloid, the active principle of Colchicum *autumnale.*

Meadow Saffron. *Colchici Cormus, Semina.* L. E. *Colchici autumnalis Bulbus.* D.—Colchicum *autumnale**, Meadow Saffron, is found in moist meadows, in many parts throughout southern and temperate Europe, and very abundantly in England: it belongs to the natural order Melanthaceæ. The *Cormus*, improperly termed a bulb, is somewhat egg-shaped; the leaves, which appear in the spring, bearing amidst them the capsules, which are three united together, are smooth, obtuse, keeled, and of a dark-green colour. The flowers, which appear in the autumn without leaves, are of a bright purple hue, with a long white radical tube. The *Cormus* is at its perfection, in this country, in June and July; but locality and climate modify this greatly. Thus Maranta and Haller state that it is sweet or tasteless and inert in the autumn, and may then be eaten: Krapf says that it is eaten in the autumn in Carniola and Istria. The perfect *Cormus*, when cut transversely, exudes a white juice, which has a sweetish, biting, acrid taste, and exhales an odour that irritates the mucous membrane of the nostrils. The juice is often so acrid, that Stoërck asserts that on rubbing some of it on his tongue, that organ swelled, became rigid, and continued as if benumbed for six hours. It is very poisonous to dogs; hence the Dutch name *Hundes hoden*, and the French name *Tue-chien*. The Swiss peasants tie the *cormi* round the necks of their children, as amulets. When good, they are heavy, firm, and when cut transversely, the slice is nearly an entire oval; when it is shrunk, the slices are panduriform.

Water, alcohol, and vinegar, extract the bitter of the Cormus. According to the analysis of Pelletier and Caventou, it contains—1, a fatty matter, formed of stearine, elaine, and a peculiar volatile acid; 2, Veratria combined with gallic acid; 3, a yellow colouring matter; 4, gum; 5, starch; and 6, inulin in abundance, besides ligneous matter. It has since, however, been ascertained that the active principle in Colchicum is not Veratria, but a distinct alkaloid, which has been named Colchicia†. It is found equally in the cormi, the flowers, and the seeds. If the flowers be macerated in wine, the salt of Colchicia which they contain is taken up, and a preparation equal in efficacy to the wine of the cormi is produced. In a similar manner, the seeds, also, yield the colchicia to wine. The alkaloid resides in the testa of the seeds, which, therefore, do not require to be bruised when put into the wine.

* Woodville's Med. Bot third ed. p. 759, pl 258. London Dispensatory, art. Colchicum. Richard, Hist. Nat. Med. t. i, p. 353. Lindley, 589. Hayne, v, 45.

† It was discovered by Geiger and Hesse, see Journ. de Chim. Med. t. x, p. 465.

Colchicia is crystallizable and soluble in water; properties which distinguish it from Veratria: it is inodorous, intensely bitter. It displays an alkaline reaction: nitric acid colours it violet, changing to blue, and, lastly, to green and yellow. It does not possess the acrimony of Veratria, nor does it excite the violent sneezing caused by the latter when snuffed up the nostrils.

Notwithstanding what is recorded regarding the impunity with which the Cormi of Colchicum *autumnale* have been occasionally eaten*, there is no doubt that the whole plant is a very active poison. Garidel, in his work, "Les Plants d'Aix," relates that a man having eaten the flowers of Colchicum, as a remedy against ague, was affected with violent pains of the bowels and other pains for several days. John Agricola Ammonius has recorded a case of two boys who were killed by eating the flowers, whilst playing with them in a field; and several cases are recorded in which children have fallen victims to the poisonous properties of the seeds. I have seen two cases of poisoning from an overdose of the wine of the Cormus; and a case is recorded in which a man took f℥iss of the tincture by mistake, and died in forty-eight hours, after suffering much from vomiting, acute pain of the stomach, colic, purging, and delirium†. Dr. Schobel, in a thesis published at Tubinjin, in 1817, has accumulated much authentic information on this subject. He states that Colchicum is poisonous to animals of all classes—horses, dogs, cats, rabbits, jackdaws, starlings, frogs, snails, and even flies; and that it acts in whatever way it is introduced into the system, whether taken into the stomach, injected into the windpipe, or applied to an external wound. Instinct leads quadrupeds to avoid the foliage in the fields; but when it is eaten mixed with other food, it powerfully affects them, causing purging of blood, inflammation, and sometimes gangrene of the intestines. In the cases of poisoning with the solution of the cormus in wine, which came under my notice, the symptoms were, dryness and heat of the gullet, great anxiety, violent agitation, tremors of the extremities, vomiting, bloody diarrhœa, cold clammy sweats, and such prostration of strength as soon terminated fatally. In some of the recorded cases, it appears to have acted more locally than usual on the gullet and stomach, producing a sensation of burning in these parts*; with giddiness, blindness, and dilated pupils. Post-mortem examinations display appearances of violent inflammation in the gullet, the stomach, and the colon; and, in some instances, through the whole mucous membrane of the intestinal canal. Some idio-

* All the species of Colchicum yield Colchicia; but, from comparative experiments on four different species, I found that the *Autumnale* yields the largest proportion, and consequently is the most active as a medicine; and the *Byzantium* yields the smallest quantity, one fourth only of that in the Autumnale: hence I am inclined to think that the bulbs of Colchicum which have been eaten with impunity, belong to the species *Byzantium*.

† Edin. Med. and Surg. Journ. vol. xiv, p. 262.

syncracies resist the poisonous effect of Colchicum in an extraordinary degree*.

Notwithstanding these violent effects of Colchicum, it is a very efficacious and valuable medicine. It was employed by the ancients under the name of Hermodactylus; and as such, it was sold in the druggists' shops in this country in the time of Turner, the herbalist; and Prosper Alpinus maintained their identity†. Alexander Trallianus, a Greek physician, who lived in the sixth century, first recommended it in gout‡: and Paulus Ægineta, who flourished in the seventh century, extols it as a *purgative* in pains of the joints; but he was also aware of its poisonous properties, and disapproved of its administration; "quoneam hermodactylus stomacho facessit negotium, anxietatem et cibi fastidium movet§." And it was, after this period, very generally employed, until some circumstance again threw it out of use, when it was only occasionally resorted to as a diuretic. The surprising effects of an empirical French remedy, the Eau-medicinale, again brought Colchicum into notice, and few medicines are now so generally employed.

Colchicia exerts a double action on the living system—a local stimulant influence, and a narcotic effect which is probably the result of the prior stimulant action. Both operate chiefly on the duodenum; exciting powerfully the excretory ducts of the liver and pancreas, producing copious bilious stools, diminishing febrile action, and allaying pain. Colchicum, nevertheless, is generally supposed to exert some specific influence. This is a doctrine which I cannot understand; but I can fully comprehend how pain and inflammation are relieved, by emptying the gall ducts and carrying a large quantity of vitiated secretions out of the habit. Its local influence on mucous surfaces generally, when it is applied to them, throws considerable light upon the rationale of its action: by causing a determination of blood to so great an extent of surface as the mucous lining of the intestines, the inflammatory action going on in the joints will necessarily be lessened, on the principle of counter-irritation; at least, it is only in this manner that its influence can be satisfactorily explained. Its primary action is purgative; its secondary, indirectly narcotic. Under whatever circumstances it is prescribed, caution is requisite not to administer it in an irritable or an inflamed condition of the mucous membrane; and as soon as the bowels are affected, its employment should be suspended, or the dose diminished.

Much of the influence of Colchicum depends on the mode of preserving the parts of the plant employed: if the cormus be the

* A lady, who was on a visit in the family of the author, took, by mistake, one fluid ounce and a half of the wine of the seeds, at bed-time, and suffered no inconvenience.

† Alpin Med. Ægyp. l. 4. ‡ Friend's Hist. i, p. 87. § Opera, lib. vii, p. 620.

part, it should be sliced very thin, and the slices dried in an obscure place at a temperature of 70° Faht. During the drying, each slice should be placed separately, on clean, colourless, bibulous paper, and turned twice: as soon as they are dry, they should be put into a well-stopped bottle. The *flowers* gathered when they are fully blown, in dry weather, and gently pressed between bibulous paper, may, when dry, be reduced to powder, and preserved in a well-stopped bottle. The *seeds* should be gathered when fully ripe: and as they undergo no change, even when exposed to the atmosphere, little care is required to preserve them in a state fit for use.

The preparations of Colchicum are made with alcohol, wine, and vinegar. Sir C. Scudamore prefers the Tincture, and states that proof spirit is the best solvent of the active principles; but its only advantage is, that the starch, gum, and inulin, are not largely taken up by the alcohol; and, therefore, it may be regarded as an alcoholic solution of the salt of Colchicum*. With regard to its superiority, experience only can determine whether a gallate, a tartrate, or an acetate of the alkaloid be the best medicine. There are two officinal TINCTURES, one† a simple alcoholic solution of the active principle of the seeds, ℥v of which bruised are acted upon by Oii of proof spirit; and the other‡ an ammoniated, aromatized solution, made with ℥v of the bruised seeds in Oii of aromatic spirit of ammonia. There are also two EXTRACTS, one§ prepared by beating lbi of the cormus to a pulp with f℥iii of pyroligneous acid; then expressing the whole and evaporating: the other‖ made by expressing the recent cormus and inspissating the juice. The Expressed-juice may be used instead of the Extract, in doses of m. x to m. xx. A small quantity of alcohol preserves it. As far as my own experience authorizes me to decide, the WINE is the preferable medicine. This is ordered by the London and the Edinburgh Colleges¶ to be prepared with the dried cormus and sherry wine. If the cormus be taken up at a proper time, it should be sliced and carefully dried, and used as soon after it is dried as possible. Sherry wine contains free Tartaric and Malic acids; but it has not yet been determined whether the salt of Colchicia contained in the wine of Colchicum be a tartrate or an acetate. The wine formed with the seeds is milder in its operation than that made with the cormus. It is prepared by digesting ℥ii of the unbruised seeds in two pints of

* This salt, as I have already stated, is asserted to be a gallate; but this is questionable.

† Tinctura Colchici, L. E. Tinctura Seminum Colchici, D. Dose, ten minims to one fluid drachm.

‡ Tinctura Colchici composita, L. Dose, ten minims to one fluid drachm.

§ Extractum Colchici aceticum, L. E. Dose, half a grain to two grains.

‖ Extractum Colchici Cormi, L. Dose, half a grain to two grains.

¶ Vinum Colchici, L. E. Dose, ten minims to one fluid drachm.

sherry for eight days. As I have said, the seeds should remain entire; for if these are bruised, the preparation is less clear and more liable to spoil, from the admixture of the feculaccous matter of the cotyledons. This wine is not officinal. The Oxymel and Vinegar shall be noticed under the head of Diuretics.

The powder of Colchicum may be employed instead of any of the preparations which I have mentioned; and in the diseases of infancy and childhood it is the best form of giving the remedy. The dose of the powder is from gr. iii to gr. ix, repeated every eight hours. The extent of the dose, however, must depend very much on the condition of the habit, and other circumstances, at the time of its administration. If the mucous membrane be in an irritable state, even gr. iii may excite both vomiting and purging: the less inflammatory the state of that membrane, the less risk attends full doses of Colchicum. Neither acetate nor diacetate of lead can be administered with the wine, insoluble compounds of the oxide of lead being thrown down; thus defeating the purpose for which the salts of lead are administered. In gouty affections, the tincture and the wine are usually combined with magnesia, on account of the acescent state of the stomach in gout, independent of any influence it has on the Colchicum: but I am inclined to think that the magnesia acts an important part in the operation of the medicine, by preventing the decomposition of the Gallate, or salt of Colchicia whatever that may be, and the formation of the Hydrochlorate, which, instead of operating on the gall-ducts, and as a secondary narcotic, would act solely on the kidneys. It may, however, be contended, that this diuretic influence is beneficial: in the decline of every gouty paroxysm, a large excretion of uric acid takes place as a critical discharge; and Dr. Chelius, of Heidelberg, ascertained that one of the effects of Colchicum on the kidneys is to augment the quantity of this excretion. This opinion of Dr. Chelius is confirmed by the observations of Dr. Lewins; and to these I may add my own. Thus, he found that, on the fourth day after taking Colchicum, the quantity of uric acid excreted was 0·069 per cent.: after four days more using it, the quantity was 0·076 per cent.: in eight days, 0·091: in twelve, 0·112, or nearly double*. We may nevertheless conclude that Colchicum in gout exerts a secondary narcotic influence; although the unloading the biliary system, by diminishing morbid excitement, effects the same result in painful inflammatory diseases, as if it were a direct Narcotic, with this superior advantage, that the benefit is more permanent.

h. Veratria.—This is an alkaline principle which was

* Annales Clin. de Heidelberg, vol. iii.

discovered by MM. Pelletier and Caventou* in the seeds of the rhizomes of Veratrum *album*† and Sabadilla.

White Hellebore, *Veratrum*. L. E. D. Sabadilla. L. E. —Veratrum *album* is a native of the South of Europe, belonging to the order *Melanthaceæ*. It rises about three or four feet in height, with alternate, longitudinally plaited, sheathing leaves, and bearing a panicle of pale, greenish flowers. The rhizome, or root-stock, the officinal part, is about two inches long, one inch in diameter at the base, but narrowing like a cone, and giving out many, simple, radical fibres; in the dry state, it is dark-coloured and much corrugated. It is inodorous, and has a sweetish taste, which becomes bitter and acrid; a property which is said to depend on *Veratria*.

The V. *Sabadilla*‡, which is, also, now officinal, is a native of Mexico and the West Indies. It is a taller plant than the V. *album*. The leaves are all radical, with 8 to 14 ribs, and glaucous underneath. The seeds, which are employed, are three in each cell, imbricated, blunt, curved, sooty, and acrid, and are contained in capsules, not unlike the capsules of Larkspur: but it is probable that Cevadilla is also the fruit of Helonias *officinalis*, as stated in the London Pharmacopœia. Cevadilla seeds are used chiefly for yielding Veratria, which they contain in larger quantity than the rhizomes of the White Hellebore.

Veratria, when pure, is a whitish-grey, pulverulent, very acrid, inodorous substance, displaying an alkaline reaction: it is scarcely soluble in cold water, and requires even a thousand parts of boiling water for its solution. It is very soluble in alcohol, in ether, and in all the vegetable acids, saturating them and forming neutral and uncrystallizable salts. With sulphuric acid it affords a bisulphate, which can be imperfectly crystallized. Nitric acid decomposes it, and produces a yellow detonating substance allied to the bitter principle of Welther. Iodine changes its white hue to a tarnished yellow; Brome to a pale yellow. According to Pelletier and Dumas, it consists of Carbon 66·75, + Oxygen 19·67, + Hydrogen 8·54, + Nitrogen 5·04, in 100 parts; or, according to Conerbe, of C. 34, H. 22, O. 6, N. eq. = 292·23. Veratria fuses at a temperature of 122° Faht., and, on cooling, assumes the appearance of pale amber. A higher temperature decomposes it, producing the same results as on the other alkaloids.

* Ann. de Chimie et Phys. t xiv, p. 69.

† Woodville's Med. Bot. 3rd edit. p. 257, pl. 573. London Dispensatory, art. Veratrum. Richard, Hist. Nat. Med. t. i, p. 358. Lindley, 585. Hayne, xiii, 26.

‡ Helonias *officinalis*, Don.; the Asagræa *officinalis* of Lindley; the Veratrum *officinale* of Schlechlendabl. These plants differ from one other. The Helonias has long, grassy, radical leaves, from amongst which the flower-stem rises, and the capsules are trifollieled; the V. *Sabadilla* has leaves as stated, dark-purplish flowers, and capsules only on one half of the circumference of the stem. The V. *Sabadilla* is still retained by the Edinburgh College. See Lindley's Flora Medica, 587 Descourtil's Flora des Antilles, iii, 195. Hayne, xiii, 27.

In minute doses, Veratria stimulates powerfully the mucous membrane, in whatever manner it is applied to it: thus, if taken into the mouth, it excites salivation ; if snuffed up the nostrils, the most violent sneezing and copious discharge ; if taken into the stomach, it stimulates both the orifices of the gall-ducts and the intestinal nerves, causing the most abundant discharge of bilious, watery stools ; and if the dose exceed a quarter of a grain, violent vomiting is induced. It has lately been externally used, as an ointment or liniment, in combination with twenty-three parts of lard, in Neuralgia and other affections of the nervous system ; but I have not found that it is more useful than many other counter-irritants.

i. CONIA, the active principle of Conium *masculatum.*

LEAVES AND SEEDS OF CONIUM.—*Conii Folia, fructus.* L. *Conium.* E. *Conium maculatum ; folia.* D.—The plant yielding these officinal substances is the Conium *maculatum*, an indigenous biennial belonging to the natural order *Umbelliferæ**. It flowers in June and July; at which time it is in perfection. Dr. Christison, however, affirms that it may be gathered for medicinal purposes at any period, even in the first year of its growth†.

It is distinguished by its *maculated* stem, which rises from two to six feet in height, erect, round, glaucous, smooth, hollow ; and by the *deep shining green* of its lower or supra-decompound leaves, consisting of ovate, closely and deeply pinnatifid leaflets, and long furrowed petioles, sheathing at the base. The flowers are white and fertile, on numerous terminal umbels, compound, many-rayed, smooth. The fruit is pale-green, ovate, compressed laterally, with sharp, wavy, elevated ridges; the commissures and channels wrinkled. The plant grows abundantly in hedge rows, and on waste rubbish, ripening its seeds in August and September. It exhales a peculiar odour, which is augmented when the fresh plant is bruised, resembling that of the urine of the cat, or mice.

The medicinal property of Conium is connected with this odour of the plant, and the green colour of its leaves. Its narcotic principle varies greatly, according to the nature of the season and the localities of the plant. Thus it is said to be a more virulent poison in Greece, Italy, and Spain, than in England : in other places it is so inert, that we are informed by M. Steven, a Russian botanist, that the Russian peasants eat it with impunity, after it has been boiled in several waters. Dr. Christison says that all Merat's statements on this subject are vague.

The fresh leaves of Conium are of a beautiful deep-green colour, have a nauseous odour when bruised, and a saline, acrid, disagreeable taste. They acquire a greyish-green tint, and lose much of their activity, both by drying and time. They require to be dried quickly, at a temperature not exceeding 120°, and

* Woodville's Med. Bot. 3rd edit. p. 104. pl. 42. London Dispensatory, art. Conium. Richard, Hist. Nat. Med. ii, p. 369. Lindley, 57. Hayne, i, 31.

† Christison's Dispensatory, p. 360.

preserved in well-corked, opaque bottles. They are sometimes mixed with the leaves of Achillea *millefolium* and Myrrhis *temulenta*. The best criterion of their goodness is the strength of the odour which they emit when they are rubbed with caustic potassa.

Schrader has given the following as the result of an analysis of the fresh leaves of Conium: in 100 parts he found of Resin 0·15, Extractive 2·73, Gum 3·52, Albumen 0·31, Green Fecula 0·18, Heterogeneous mass 92·49. This heterogeneous mass was a compound of acetic acid, sulphate, hydrochlorate, and nitrate of potassa, malate and phosphate of lime, with the phosphates of iron, magnesia, and manganese. M. Giseke obtained an alkaline principle from the leaves, to which the name of *Conicin* or *Conia* was given: but its characters were unknown until it was carefully examined by Geiger in 1831, and afterwards by Dr. Christison*. It is a fluid, volatile alkali, oily in its aspect, colourless at first, but rapidly acquiring colour if exposed to the air, depositing a resin, and losing its activity. Its odour is peculiar, intensely suffocating; its taste acrid and benumbing. It boils at 370°, and distils in close vessels without undergoing any change: it distils over with water, but is sparingly soluble in that fluid, although it forms a hydrate with it. It is soluble in alcohol, ether, and in fixed and volatile oils; and it forms uncrystallizable salts with acids. It is prepared by evaporating the alcoholic solution of the unripe seeds to dryness, then adding to the residue a strong solution of potassa, and distilling: the Conia is developed, distils over with the water, and floats on its surface. According to Leibig, Conia consists of 66·913 of Carbon, + 12·000 Hydrogen, + 12·805 Nitrogen, + 8·282 Oxygen, = 100·000; or, C. 12, H. 14, N. 1, O. 1, equiv. = 109·59. Its action on the animal œconomy is that of a powerful sedative poison: displaying its influence by its paralyzing effects. The post-mortem examination of animals killed by it displays the vessels of the head, the right auricle of the heart, the vena cava superior, and the jugulars, gorged with blood: but no traces of irritation appear in the abdominal viscera.

About twenty-five years ago, by acting upon hemlock with ether, and evaporating the etherial tincture on the surface of water, I obtained a rich-green resinous-like substance, which possesses, in an eminent degree, the odour and taste of the recent plant; and half a grain of which produces headache and vertigo. To this principle Dr. Paris proposed to give the name *Conein*, which I ventured to change to *Conia*. But the experiments of Geiger and Dr. Christison† have set aside the idea that this is the active principle of Conium, although it evidently contains it in a concentrated degree.

Many circumstances concur to alter the powers of Conium on the animal system: some relate to the plant itself, and its

* Trans. of Roy. Soc. Edin. vol. xiii. † Ibid, 1836.

preparations; others to the temperament and idiosyncracy of the patient, and the nature of his diseases; but its action is not fully understood.

As far as concerns the plant, the leaves should be gathered in June; they should be healthy, and of a deep-green colour; and, as soon after being gathered as possible, they should be quickly dried in an obscure place, as light deteriorates them; the powder should also be secured from the action of light, and preserved in small bottles, almost hermetically closed.

The dose of the powdered leaves is from gr. iii to gr. x; that of the Conia is from one tenth to one fourth of a grain.

The EXTRACT, *Extractum Conii*, L. E. *Succus Spissatus Conii*, D. is the form most commonly used. It is prepared in two ways: the expressed juice is evaporated to the consistence of syrup, and the powder then added to bring it to a proper degree of thickness for making pills: or the expressed juice is evaporated in shallow dishes without heat. The latter method affords the best extract. Much care is requisite in these processes: even a moderate heat, in any of the steps of the first process, may be sufficient to destroy the efficacy of the preparation. It would also be advantageous, were the plant, for medicinal use, collected in the south of Europe; dried in an obscure place, without heat; powdered and sent to this country, and to other parts in the north of Europe, in well-soldered tin canisters. By such means, if no adulteration occurred, an efficient medicine would be obtained.

The Extract, when properly prepared, is a most efficient preparation: the dose, at first, is gr. iii, but it may be gradually increased to ʒss three times a day. In cases of carcinoma, I have given it to the extent of ℈iv daily, for several weeks, without any disadvantage; on the contrary, with the most comfortable anodyne effect on the sufferings of the patient. There is some difficulty in preserving the Extract: whenever a saline efflorescence appears on the surface, it is of no value.

The TINCTURE OF CONIUM, *Tinctura Conii*, L. E. D. is well prepared only by the Edinburgh formula; and only in that state can be regarded as a certain medicine. Twelve ounces of the leaves and the juice are expressed; the marc then bruised is put into a percolator, and half a pint of Tincture of Cardomums, and a pint and a half of Rectified Spirit passed through it into the expressed juice; after which the whole fluid is filtered. The dose is from fʒss to fʒi.

The Dublin College orders, also, an OINTMENT, *Unguentum Conii*, D.*; and a CATAPLASM, *Cataplasma Conii*, L. D.†: both of which are useful topical applications.

* Take of the fresh leaves of Conium, and of prepared Lard, of each *one pound*; boil the leaves in the lard until they shrivel, and strain through linen

† Take of dried leaves of Conium one ounce, water a pint and a half; boil down to a pint, and add to the strained decoction enough of powder to make a poultice.

With respect to the state of the patient, Conium affects less those of a melancholic than those of a sanguine temperament; and idiosyncracy interferes little with the operation of Conium. These circumstances, therefore, not only tend to perplex the practitioner, but to produce very varying opinions respecting the general powers of the medicine. That Conium operates as a local sedative is evident from the effect of poultices made with it. The primary action, therefore, of the active principle is on the tissues to which it is applied—the throat feels dry, an uneasy sensation is felt in the epigastrium, and colic and nausea are excited. It next enters the circulation, and, acting upon the heart, augments, at first, the force of the pulse, and renders it irregular: and this action, extending to the capillaries, causes the suffusion of the eyes, the heat, itching, and eruptions on the skin, that sometimes accompany its use. But its chief influence is exerted on the cerebro-spinal organs. It seems to act on the whole brain, causing headache, beating in the temples, pain in the orbits, heat in the cranium, noise in the ears, and, when the dose has been very large, high delirium. Its action on the spine is marked by tremblings in the extremities, palpitations of the heart, nausea, and vomiting. Under these circumstances, it is evident that the nervous plexuses of the great sympathetic are affected; and, indeed, a new action of a morbid kind appears to be set up by it, in every part of the nervous system.

From this catalogue of its effects, the powerful influence of Conium as a therapeutical agent may readily be conceived: and unless these symptoms are present in a moderate degree, it produces no beneficial results. Besides these effects, it is also supposed to determine to the genitals, and, on this account, it is prescribed in impotency, in Germany*; but of its influence in this respect there is much doubt.

Upon the whole, we may affirm that Conium is a Narcotic; that, if due attention be given to prepare it, so that its preparations may always be of uniform strength, and if the dose be carried to its utmost extent, it merits more attention than has hitherto been paid to it by British practitioners.

The best form of preparation is the Tincture. Much comfort may be procured by applying the extract as a topical dressing to cancerous sores; and I know of no better means of allaying the pain of cancer before it ulcerates than the Hemlock poultice.

When Conium has been overdosed and acts as a poison, its effects greatly resemble those caused by opium. It first produces giddiness and headache, followed by drowsiness, so intense that the patients fall asleep whilst they are conversing: coma and convulsions follow, and, if proper means be not taken to obviate the fatal result, death rapidly ensues. It also affects

* "Impotentiam virilem sub usu Conii curatum observavi, in viro quodam plusquam quadragenario, qui omnem erectionem penis prediderat, postinde tamen plures liberas procreavit," says Bergius, an author of great credit.

the respiratory function; the breathing becoming constricted and laborious; the pulse small, and beating scarcely thirty in the minute; the extremities become cold, the countenance bloated, bluish, and turgid with blood, like that of a man in the act of strangulation. Post-mortem examinations of the body display great turgidity of the vessels of the head; but Dr. Christison affirms that it does not prevent the blood from coagulating as has been asserted*. The most prompt means of abstracting the poison from the stomach must be resorted to: if the stomach-pump be not at hand, the strongest direct emetics should be administered. I am not aware that any agent acts chemically upon the poison. But vinegar and the vegetable acids diminish its energy.

k. LEAVES AND SEEDS OF FOXGLOVE. *Digitalis folia semina.* L. *Digitalis.* E. D. — The plant which bears these leaves and seeds, the Digitalis *purpurea*, is indigenous, and belongs to the natural order Scrophulariaceæ†. It is a biennial plant, very common on elevated ground, where the soil is dry, chalky or sandy, and gravelly. The beauty of the flowers has given the plant a place in gardens; but its properties as a medicinal agent are much deteriorated by cultivation. The plant rises from three to four feet in height, with alternate, ovate-oblong, soft, velvety, crenate, dull-green leaves, which terminate, at the base, in a winged footstalk‡. The flowers are arranged on one-sided racemes, opening from the base upwards, bell-shaped, crimson, and beautifully spotted and hairy within: the fruit is a capsule, containing many small, oblong, pale-brown, pitted seeds. The best plants for medicinal use are those which grow on elevated situations, exposed to the sun. The leaves should be gathered when the plant begins to flower: those of the first year's growth are of little value§. They are all radical at this stage of its growth. The recent leaves have no odour; but they impress a permanent, bitter, nauseous taste. They impart their properties to water, alcohol, ether, and even to weak acids. The aqueous Infusion is precipitated by infusion and tincture of galls; and is coloured dark-green with solutions of the sesqui-salts of iron, owing to a trace of tannic acid which they contain. According to Brandt and Poggiale, their other constituents are resin, fatty matter, starch, gum, volatile and fixed, chlorophylle, oxalate of potassa, and salts of lime and potassa||.

* Christison's Dispensatory, p. 363

† Woodville's Med. Bot. 3rd edit. p. 218, pl. 78. London Dispensatory, art. Digitalis Richard, Hist. Nat. Med. t ii, p. 74. Lindley, 502. Hayne, i, 45.

‡ A knowledge of the form of the leaves is important, as they are often mixed with the leaves of Verbascum and Comfrey.

§ Dr. Christison, however, asserts that an Extract made with them is an energetic poison. Dispensatory, p. 400.

|| Journ. de Pharm xxi, p. 130.

When ℥i of the leaves of foxglove are acted on by alcohol, the spirit takes up about gr. xx, and leaves, on evaporation, a green matter, resembling tallow in consistence, but more tenacious, and having a disagreeable, virulent smell. It does not furnish ammonia by distillation, and is not acted upon by acids. It is intensely bitter, and possesses all the activity of the plant in an eminent degree. This substance is still better extracted from the dried leaves by acting on them with ether, both cold and warm, and evaporating to an extract, which is to be taken up with distilled water, to separate some chlorophylle. The Digitalia of M. Leroyer and of M. Pauguy, who obtained it from Digitalis as a white crystalline substance, in fine acicular crystals, insoluble in water, but soluble in alcohol and ether, does not display any of the virtues of the plant; I shall, therefore, make no comment upon it. The preparations of Digitalis are an Extract, Infusion, and a Tincture.

Extract of Digitalis, *Extractum Digitalis*, E. is an uncertain preparation. The dose is from gr. ss to gr. i.

Infusion of Digitalis, *Infusum Digitalis*, L. E. D. is as uncertain as the Extract. It is coloured greenish-black by sesqui salts of Iron, and is precipitated by Tincture of Galls and other astringents. The dose is from f℥iv to f℥ii.

Tincture of Digitalis, *Tinctura Digitalis*, L. E. D. is also an uncertain preparation, owing to the careless manner in which the leaves are frequently dried. The dose is m. x to m. xx. It would be of great importance to obtain a vehicle which should always ensure a preparation of a definite strength. I am disposed to think that such a vehicle will be found in ether, which takes up the whole of the soluble matter, and, when evaporated, leaves a green extract, possessing in a high degree the properties of the plant. The solution of this in alcohol might be employed, as a Tincture, with advantage.

As a Narcotic, foxglove operates upon the nervous system, producing stimulant, and afterwards sedative, effects. This was first satisfactorily ascertained by Dr. Hallaran, in a case of Insanity, in which the Tincture of Foxglove was given by mistake for the tincture of opium; and he concluded, from observing its action in different states of Mania, that Foxglove cannot be advantageously exhibited under "the pressure of high arterial action*." This fact, indeed, had been previously noticed in some experiments by Dr. Saunders†; and, during the employment of foxglove as a diuretic, it seldom succeeded if the dropsical patient was in a state of vascular excitement; but this was ascribed to other circumstances than to the primary stimulant action of the foxglove. Dr. Hallaran employed foxglove with great advantage as a Narcotic in cases if diminished excite-

* Practical Observations on Insanity, p. 105—109.

† Treatise on Pulmonary Consumption, p 243, 8vo. Edin. 1808.

ment of a maniacal kind: and my own experience has enabled me fully to confirm the accuracy of Dr. Hallaran's observations. This opinion is further confirmed by the experiments of M. Jorg and a Leipsic Club of Experimentalists. They found that from half a grain to three grains of the powder excite, directly and powerfully, the brain and the alimentary canal; and that its secondary effects are sedative, and evident on the circulation, which it depresses. Its influence on the brain is indicated by giddiness, dull headache, heat of face, obscure sight, and intoxication, with spectral delusions: its operation on the alimentary canal, by heat in the pharynx, colic, and costiveness: its secondary or sedative influence, by a small, feeble, irregular pulse. It is only by regarding it in this point of view, that we can account for the contradictory statements of practitioners respecting the influence of Foxglove in diseases of excitement; for example, pneumonia, phrenitis, and similar affections; the effects of the remedy being in a great degree regulated by the period of the disease at which it is administered. I have had several opportunities of putting this mode of employing foxglove, as a Narcotic, to the test of experience; and when the system was unloaded, previously to the commencement of the use of the tincture, which I have carried to the extent of sixty minims, three times in the twenty-four hours, I have seldom failed of procuring sleep, quiet, and the restoration of the patient to sound health and intellect. In one of these cases, which has since remained under my eye, the lady, a woman of eighty years of age, has continued for upwards of seven years in perfect mental health. In producing its effects, Digitalis cannot, with safety or advantage, be ventured on where the inflammatory diathesis presents itself; and, therefore, in other diseases, as well as mania, in which its narcotic influence may be required, the habit should be prepared by previous depletion. From these remarks, it is easy to ascertain the periods of disease in which Foxglove is most likely to prove beneficial. The sedative influence of Foxglove, however, is still maintained by many practitioners, among whom Dr. Christison has placed himself*; but, at the same time, he admits its narcotic influence.

The influence of Foxglove as a diuretic shall be noticed in its proper place. Its effects, when overdosed, are those of a powerful narcotic poison. Sinking of the pulse, clammy perspirations, nausea, vomiting, and purging, are the most marked symptoms produced by it: sometimes salivation supervenes, and suppression of urine. These symptoms arise from collapse, the effect of its stimulant influence. Like mercury, Foxglove accumulates in the system, when long administered, even in moderate doses; and continues to produce its constitutional effects after its use has been discontinued. The symptoms, in

* Dispensatory, p. 461.

such a case, are nausea, vomiting, giddiness, want of sleep, sense of heat over the body, pulsation in the head, depression of spirits, sometimes diarrhœa; occasionally, profuse salivation and convulsions supervene, with a peculiar forgetfulness and delirium. Even when death does not follow, the effect on the pulse does not disappear for many days. When symptoms of poisoning occur, they are to be counteracted by immediately suspending the use of the medicine, and administering cordials, as brandy and water, ammonia, opium, and the application of a blister to the pit of the stomach. Yellow cinchona bark, also, is an excellent antidote, as it forms an insoluble compound with the Tincture and Infusion of Foxglove.

The most common form of using the leaves of Foxglove is in *Powder*. But this should not be employed unless it possess the beautiful green colour of the fresh plant; and to secure this state, the leaves should be quickly dried between bibulous paper, and preserved in opaque bottles. The dose at first should not exceed a grain, or a grain and a half; but it may be repeated once in eight hours, until the action be obvious, after which the dose should not be given oftener than once in twelve hours; then, in a day or two, once in twenty-four hours; and, ultimately, once in forty-eight hours. Calomel may be advantageously joined with Digitalis. The *Infusion* is incompatible with acetate of lead, infusion of yellow Cinchona, and the alkalies. The *Tincture* is assuredly the best of the officinal preparations: it should be made with the leaves, collected in warm weather, and dried without artificial heat. In prescribing it, we must bear in recollection that both the bichloride of mercury and the nitrate of silver are incompatible in prescriptions with it.

The Edinburgh College orders a Pill, *Pilulæ Digitalis et Scillæ*, E, which shall be noticed under *Diuretics*.

l. Picrotoxia, or *Picrotoxic acid*, the active principle of the fruit of Anamirta *Cocculus*.

Cocculus Indicus. *Cocculus*. E. *Cocculi suberosi fructus*. D. —The plant yielding this fruit, the Anamirta *Cocculus**, is a native of the coast of Malabar, and belongs to the natural order Menispermaceæ. It is a climbing plant, with an ash-coloured, deeply-fissured, corky bark, bearing roundish, acute, hard, leathery leaves, six inches long and six inches broad, with five-digitate ribs. The male and female organs are in distinct flowers: the latter in lateral compound racemes. The fruit is a drupe, globose, about the size of a large pea.

As imported into this country, Cocculus Indicus resembles a rugose, large pepper-corn of a dark-brown colour, enclosing a thin, woody pericarp, with a roundish or kidney-shaped seed, fatty and inodorous, but impressing an intense, disagreeable,

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* Woodville's Med. Bot. 3rd edit. v, p. 22. Richard, Hist. Nat. Med. vol. ii, p. 610. Linnean Tran. xiii, p. 52. Lindley, 371. Gærtner's Fruct. lxx, f. 1.

bitter taste on the palate. The kernel contains *Picrotoxia**, the pericarp two alkaloids, namely, *Menispermia* and *Paramenispermia*†.

Picrotoxia is procured by expressing a concrete oil from the kernels, then acting upon the residue, reduced to powder, with rectified spirit, and obtaining an extract from the Tincture, by distilling of the spirit in a vapour bath. This extract is next to be agitated with boiling water, acidulated with Hydrochloric acid; an oily matter floats on the surface of the solution, and leaves the picrotoxia in solution. Crystals are obtained by concentration; but they require to be decoloured and purified. The salt, when pure, is in rhombic prisms, inodorous, intensely bitter, soluble in twenty-five parts of boiling water, three of alcohol, and two of ether. It is an acid, composed of C. 12, H. 7, O. 5, equiv. = 120·44. According to Gay-Lussac, the alkaloids are compounds of C. 18, H. 12, O. 2, N. equiv. = 152·31.

Cocculus Indicus exerts a potent narcotic influence on the habit; and, in large doses, is a virulent poison. It has not been internally administered as a therapeutical agent in this country; but an ointment of it is ordered by the Edinburgh College‡. Geiger employed an ointment, made with ten grains of Picrotoxia and an ounce of Lard, in ringworm of the scalp.

m. LUPULIN is a peculiar compound principle, spontaneously formed in the strobules of the hop.

THE HOP, *Lupulus*, L. E. *Humulus*, D. the strobule of the Humulus *Lupulus*§, a well-known plant of the natural order Urticaceæ. It is a native of the Continent of Europe, and of North America. It is extensively cultivated in Kent, Surrey, and other parts of England. The stem is annual, but the root perennial; the former is climbing and twining. The flowers are unisexual, and the female is succeeded by a scaly, imbricated strobule, which is the officinal part, and, when dried on kilns, forms the Hops of commerce.

Hops have a strong peculiar odour, and an aromatic bitter taste; the former is dissipated by time, but not the latter: their properties reside in granular bodies that surround the seeds, and are easily detached by rubbing and sifting the strobules. These granules constitute Lupulin. It was first brought into notice by Dr. Ives, of New York; and the hop was soon afterwards chemically examined by M. Payen and Chevalier, two French chemists. The result of their experiments led them to conclude that the lupulin grains contain 2 per cent. of volatile oil, 10 of bit-

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* Ann. de Chim. lxxx, p. 209.

† Discovered by Pelletier and Conerbe, 1834. Ann. Chim. et Phys. liv, p. 181.

‡ Unguentum Cocculi, E. It is made by bruising one part of the kernels in a mortar alone, and then triturating them with five of lard.

§ Woodville's Med. Bot. 3rd edit. vol. v, p. 90, pl. 22. London Dispensatory, art. Humulus. Richard, Hist. Nat. Med. t. ii, p. 478. Lindley, 296. Hayne, iii, 164.

ter extractive, and 55 of resin, besides carbonic acid, diacetate of ammonia, traces of osmazome, gum, malic acid, malate of lime, silica, traces of carbonate, hydrochlorate, and sulphate of potassa, carbonate and phosphate of lime, oxide of iron, and some sulphur*. They found the scales of the strobules to contain an astringent principle, colouring matter, gum, salts, similar to those of Lupulin, and lignin. As might reasonably be supposed, no light was thrown upon the medicinal character of Lupulin by the display of this long list of constituents of the hop. The volatile oil, when separated from the Lupulin by distillation with water, is of a yellow colour, acrid to the taste, and emitting the odour of the Hop. Its sp. gr. is 0910. It is soluble both in water and in alcohol; and thickens when exposed to the air. Lupulin constitutes nearly a sixth of good, well-dried Hops; but, if they have been too ripe when gathered, the quantity is less. The bitter principle, or lupulite, as it has been called, is separated by treating the lupulin with water, forming it into an extract with a little lime, and then acting upon it with alcohol. The tincture is next to be evaporated to dryness, the residue acted on by water, and the filtered solution evaporated to dryness. It is a yellowish-white, very bitter extract, which is soluble in water and alcohol, but scarcely in ether. Its aqueous solution is rendered turbid by all the mineral acids; its colour is greatly deepened by the alkalies, but no precipitates are thrown down by them: the salts of iron, mercury, and zinc, form precipitates in Infusion of Hops.

The narcotic properties of Hops have been long known: even their odour has an hypnotic influence; and a pillow of them has been successfully employed to procure sleep in mania. But the expectations that were some years since raised respecting the narcotic properties of Hop and Lupulin, have been completely disappointed. The Hop itself, as a remedy, can only be regarded as a pleasant bitter; the best mode of exhibiting which is in well-brewed beer. The Lupulin is a weak Narcotic: it may be administered in the form of powder, in doses between ten grains and a scruple, or in that of Tincture or of Extract. From forty to sixty minims of the Tincture are said to act kindly as a soporific. Hops are administered in the form of Extract†, Infusion‡, and Tincture§.

n. Camphor, *Camphora*. L. E. D. — Camphor (page 71) possesses narcotic properties which closely resemble those of opium, the stimulant being followed by collapse in the direct

* Journ. de Pharm. viii, p. 209.

† Extractum Lupuli, L. E. Extractum Humuli, D. Dose, ten grains to one scruple.

‡ Infusum Lupuli, L. Dose, one fluid ounce to four fluid ounces.

§ Tinctura Lupuli, L. E. T. Humuli, D. Dose, thirty minims to two fluid drachms.

ratio of the excitement: it also displays anodyne effects, producing sleep* and relieving pain.

When dangerous doses have been taken, the symptoms are burning heat of skin, a hard, full, and quick pulse; the eyes sparkle, the face is red and swelled, with great weight of head, anxiety, agitation, a sensation of burning in the stomach, intense cephalalgia, vertigo, and disordered vision. These symptoms have followed a dose of one hundred and sixty grains. The best treatment, in such cases, is the repeated administration, every half-hour, of a spoonful of vinegar and gruel. In a case related by Professor Wendt†, the sufferer, who was thus treated, became more calm: the cephalalgia and anxiety diminished; a copious sweat broke out, and this was succeeded by three hours of tranquil sleep; the pulse, nevertheless, continued quick and full; the urine was obstructed, and for some time was passed with difficulty. Under the use of an infusion of Foxglove and Acetate of Potassa, his health was gradually restored. In a few instances, a cutaneous eruption has followed its use; but this indicates some peculiar idiosyncracy. It causes no irritation of the mucous membrane of the intestinal canal; excites neither pain nor borborygmi; but occasionally causes constipation. Such are the narcotic effects of Camphor when it is taken into the stomach of a healthy man; but disease has a powerful influence in modifying its action.

Many unsatisfactory experiments have been made to ascertain the real influence of Camphor as a narcotic on the animal œconomy. When it is intended that it should exert a stimulant effect, it should be given in small doses, frequently repeated; on the contrary, it should be given in large doses, and at considerable intervals, when its sedative influence is required.

Camphor operates either as a stimulant or a sedative, according to the manner in which it is administered; but its effects are, in every respect, inferior to those of opium and many other narcotics.

Camphor is exhibited in various forms as a narcotic. The officinal forms are too weak to operate as narcotics: the quantity requires to be considerable, to produce a soothing effect; and therefore it should be given either in substance, in the form of pill, or precipitated from alcohol and diffused in almond emulsion or mucilage and water; or it may be dissolved in water impregnated with carbonic acid, as with that acid it forms a complete solution. The best vehicle for administering it, as a narcotic, is sulphuric ether, or the spirit of nitric ether. Two

* Haller states, that persons employed to empty bags of Camphor become first highly exhilarated, and then fall asleep, even when they are conversing.

† Professor Wendt, Rust's Magazine, tom. xxv, states that the man, who was seventy-three years of age, swallowed four fluid ounces of Camphorated Spirit: but here the quantity of alcohol was a dangerous dose.

fluid drachms of the latter can hold a scruple of Camphor in solution; and it is not precipitated when water is added. Some of the Continental physicians advise Camphor always to be administered in the state of vapour, when its anodyne powers are required. This is effected by placing the patient on a chair with an open cane bottom, beneath which a chafing dish, covered with a plate of iron, is placed; and the whole being surrounded with a blanket, pinned round the neck of the patient, a dessert spoonful of Camphor in powder is thrown upon the hot iron plate, which volatilizes it, and involves the body in an atmosphere of the vapour. The patient perspires copiously, and is freed from pain, and in three-quarters of an hour afterwards he is to be rolled in the blanket and carried to bed. The sweating is then to be kept up by tepid fluids. In chronic rheumatism, the disease for the relief of which this Camphor bath is chiefly used, the fumigation may be repeated three or four times a day; and it ought to be continued for some time after the pains have disappeared*.

Chemists have looked for Alkaloids in every medicine which displays narcotic properties: but, in various instances, they have been disappointed; and, consequently, the influence of the vegetable, in its entire state, is presumed to depend on something else than an alkaloid. No alkaline principle has been found in the following Narcotics.

o. Rhododendron Crysanthum, *Yellow Rhododendron*, is a Siberian plant, belonging to the natural order Ericaceæ†. Either from the effects of drying and transport, or from the nature of the constitutions of the patients in this country, the effects of this narcotic have been very different, when used in Britain, from those experienced in Siberia. There, its influence as a narcotic is so well known that its vulgar name implies *intoxicating tea*. According to Pallas and Koelpin, it is used in gout and chronic rheumatism. The Siberians infuse two drachms of the leaves in twelve fluid ounces of hot water, for a night, in a warm place. The dose is taken in the morning, on an empty stomach: it soon nauseates; and while this continues, no food is allowed to be taken. After some time, it generally produces a copious, black, fetid motion; and the patient rises free from pain, if the disease be rheumatism: if it be gout, the medicine requires to be repeated for three successive days before the paroxysm yields. Could such effects be obtained from it in this country, it certainly would be a most valuable addition to our Materia

* The most recent and best account of Camphor and its virtues is contained in the Traité de Camphor of Graffenaur, published at Strasburg in 1823.

† Woodville's Med. Bot. 3rd edit. p. 299, pl. 105. Lindley, 378.

Medica; but this not being the case, it has been rejected from the Pharmacopœias.

LACTUCARIUM. L. E. *Lactuca Sativa herba.* D. *Lactuca virosa folia.* D.—The genus Lactuca yields a white proper juice which has much of the sensible properties of opium when inspissated. This juice, termed *Lactucarium,* was first introduced to the notice of the profession by Dr. Coxe, of Philadelphia. An expressed inspissated juice of the lettuce, termed *Thrydacé*, from θρίδαξ, the Greek for lettuce, is used by the Continental physicians.

The Lactucarium is procured from both the L. *virosa* and the L. *sativa** ; plants belonging to the natural order *Chicoraceæ.* The former is well known, being cultivated for the table; the latter grows wild in hedge-rows and waste places. It has a rank odour, distant, spatulate leaves, bristled on the keel, and the stem maculated with blood-red spots. M. Schutz procured from one plant of the L. *virosa* fifty-six grains of dry Lactucarium, and seventeen grains only from a plant of the same weight of the L. *sativa.* The best time for procuring Lactucarium is when the plant is in flower; for at this time the vessels are so turgid with proper juice, that merely touching the flowering pedicels causes it to exude. This effect is justly ascribed to the greatly increased irritability of the plant at this time. When the vessel is excited, the part contracts so suddenly as to burst the coat of the portion above it, in which the superabundant juice is thrown.

Various means are employed for collecting this proper juice; the simplest is to make transverse incisions in the stems of the plants, to scrape off the exuded juice with a thin silver spatula, and collect it in a glass or porcelain vessel, in which it should be left to thicken in the ordinary temperature of the air, or exposed to a heat not exceeding 120° Fahr. The *thrydacé* of the French differs in being the expressed juice, and consequently in containing a variety of products besides the proper juice of the plants.

Lactucarium has the colour, and, in some degree, the odour and taste of opium. Water at 60° dissolves about 18, boiling water 33 parts in 100; proof spirit, alcohol, and ether, a much larger proportion. The solutions contain the narcotic part of the preparation, whatever that may be, as it removes all the bitterness; the other constituents, according to an analysis of Pfaff, are 8·10 parts of wax, 7·4 of resin, and 22 of caoutchouc. According to Walz, it contains volatile oil, a yellowish-red tasteless resin, a greenish-yellow acrid resin, crystallizable and uncrystallizable sugar, peptic acid, albumen, a brown, basic substance, humic extractive, a concrete oil or wax, numerous salts and lactucin, a sub-

* Woodville's Med. Bot. third edit. p. 76, pl. 31. London Dispensatory, art. Lactuca. Richard, Hist. Nat. Med. Lindley, 469. L. s. Hayne, vii; L. v. xxx—i, 47.

stance which he regards as the active principle of the juice. Lactucin is a crystallizable substance, obtained in acicular crystals, white, inodorous, intensely bitter, soluble in 80 parts of cold water, and soluble also in alcohol, ether, acetic acid, and the diluted mineral acids*. Caventou, Dublanc, jun. and Ganzel, examined Lactucarium expressly with the view of obtaining morphia from it; but could procure none. The narcotic principle of Lactucarium is, therefore, either Lactucin, or it is still unknown.

The narcotic properties of Lettuce were very early known: Galen, who in the decline of his life suffered from wakefulness, found much comfort in eating a lettuce in the evening; and every one who has indulged in the same luxury must have experienced the soporific effects of this plant. Celsus also mentions its soporific powers: "Somno vero aptum est lactuca, maximeque æstiva, cujus cauliculus jam lacte repletus est†." Dr. Coxe made a set of experiments to ascertain how far Lactucarium resembled opium in its medicinal influence: he found that the effects were precisely the same as those of opium: but although it may be used as a substitute for opium by persons who, from idiosyncracy, cannot take opium without suffering, yet its properties are much less potent. Coxe's results were confirmed by the subsequent experiments of Dr. Duncan, sen. The dose of *Lactucarium*, E. *Extractum Lactucæ*, L. in the solid form, is from one grain to twenty grains. The best preparation is the Tincture.

TINCTURE OF LACTUCARIUM, *Tinctura Lactucarii*, E. is made with ℥ii of Lactucarium and Oi of Proof Spirit: the dose is fʒi to fʒiii. The Edinburgh College, also, orders Lozenges‡ to serve as a substitute for those of opium.

LEOPARD'S BANE. *Arnica Montana*. D.—This plant is a native of the northern Alps, and arranged in the natural order Asteraceæ§. Its active principle is probably Strychnia or Brucia, as its action closely resembles that of Nux-vomica; and it appears to contain Strychnic acid, the ammoniated sulphate of copper colouring the infusion green. Its flowers, leaves, and root, also possess narcotic powers, depending on the same unknown principle. The action of Arnica is at first powerfully stimulant, irritating the whole of the alimentary canal when the dose exceeds ten grains: it excites the brain, accelerates the pulse, and increases the function of the skin. These effects may result from one dose, and usually continue longer than twenty-four hours: they are followed by sleep. The flowers of Arnica are seldom or never employed in this country.

* Ann. de Pharm, t. xxxii. † De Medicina, lib. ii, § xxxii.
‡ Trochisci Lactucarii, E. Dose, twenty to forty daily.
§ Woodville's Med. Bot. 3rd edit. p. 41. pl. 17. Flor. Dan. t. 728. London Dispensatory, art. Arnica. Richard, Hist. Nat Med. ii, 241. Lindley, 465. Hayne, vi, 47.

Poison Oak. *Toxicodendron.* L. D.—Rhus *Toxicodendron* belongs to the natural order Anacardiaceæ. It is a native of North America*. The proper juice of the plant is white; but it becomes black by absorbing oxygen when it is exposed to the action of the air; and on this account it is used as a varnish in Japan. A volatile principle is exhaled from the living plant, which acts powerfully upon the skin, inflaming and blistering it. Van Mons, who examined this exhalation, states that it is given out chiefly during the night, and is combined with carburetted hydrogen gas. This opinion, however, is of little weight, and merely conjectural.

The leaves, the parts of the plant medicinally employed, yield their virtues both to water and alcohol. They have an astringent taste, but no acridity in their dry state. Besides their unknown narcotic principle, they contain also a large proportion of tannic acid, mucus, and extractive; on which account, the infusion yields precipitates with the salts of iron. Acids decolour it; the alkalies greatly deepen the colour.

As a narcotic, the leaves of the Toxicodendron have been much praised by Dr. Alderson, of Hull, in paralysis†. They cause a sense of heat and pricking in the affected limb—symptoms that anticipate the relief or the cure of the disease. These facts, which were first promulgated by Dr. Alderson, have not been confirmed by other practitioners in this country; but Dr. Gevesins, in some experiments with this plant in paralytic diseases, found that four out of five of the cases treated with Toxicodendron were cured. He gave it in doses of a quarter of a grain twice a day. The dose may be gradually increased to four grains.

INORGANIC PRODUCTS WHICH OPERATE AS NARCOTICS.

ÆTHER.

* *Free.*

a. Sulphuric Ether. *Æther Sulphuricus.* L. E. D.—I may notice here the method of purifying Æther recommended by the Edinburgh College, as it answers better than any which I have tried. The impure Ether is agitated with a concentrated solution of Chloride of Calcium containing about $\frac{1}{32}$ of recent unslaked lime, which saturates the sulphurous acid, whilst the Chloride removes the water and any alcohol mingled with it. The supernatant fluid is then to be distilled with a gentle heat as long as Ether of sp. gr. 0·735 passes over. More Ether of equal

* Woodville's Med. Bot. 3rd edit. vol. v, p. 67. London Dispensatory, art. Rhus.

† Essay on Rhus Toxicodendron, 3rd edit. 1804.

strength may be procured from the chloride of calcium. The sp. gr. 0·750 indicates an impure preparation, namely, an Ether containing both alcohol and water. Like all other diffusible excitants, Sulphuric Ether produces narcotic effects; but it is seldom administered, except in combination with more decided narcotics than itself.

* * *Combined.*

b. SPIRIT OF SULPHURIC ETHER. *Spiritus Ætheris Sulphurici.* E. *Liquor Æthereus Sulphuricus.* D.—In whatever manner prepared, this is a simple mixture of Ether and Alcohol. Its narcotic powers are precisely the same as those of Ether.

c. COMPOUND SPIRIT OF SULPHURIC ETHER. *Spiritus Ætheris Sulphurici compositus.* L. Syn. *Hoffman's Anodyne.* In preparing Sulphuric Ether, and continuing the process after white fumes are disengaged, sulphurous acid is evolved, and a yellowish fluid, termed *etherial oil, oleum æthereum**, passes into the receiver: f℈iii of this Oil and f℥viii of Sulphuric Ether, and f℥xvi of Rectified Spirit, form the preparation now under review. The etherial oil has a fragrant odour, and a bitter, pungent taste: its specific gravity is 1130; and, according to Leibig, it consists of 2 eq. of Sulphuric Acid, 8 of Carbon, + 8 of Hydrogen, + 1 water, equiv. = 146·16. It is to the etherial oil that this preparation is supposed to owe its anodyne and soporific powers. In doses of thirty minims, in a fluid ounce and a half of camphor mixture, this Spirit of Ether allays pain and operates as a gentle soporific. It is considerably less exciting than simple Ether.

B. INDIRECT NARCOTICS.

IMPONDERABLE AGENTS.

There can be no doubt that both painful and pleasurable feelings, arising from mental causes, are felt upon the body, and often produce great and striking physical changes on the organs, especially on the heart and the lungs. Almost every anxiety, and even every pleasurable feeling, is felt about the præcordia; and the common experience of mankind, in reference to this fact, has led to the expressions which we daily hear, when individuals are under the influence of pleasurable or painful emotions. We are told " that a load is removed from the heart,—that it is

* It is now ordered to be prepared by mixing together cautiously and distilling two pounds of Rectified Spirit and four pounds of Sulphuric Acid, until a black froth rises; then separating the light fluid from the heavier, exposing it to the air for a day; and, lastly, agitating it with solution of pure Potassa and water, one fluid ounce of each, and washing the oil, which subsides.

light,—that it jumps for joy;" or, on the other hand, we also hear "that it is oppressed,—it is full,—ready to break," and so on. Now, the source of all these expressions is the corporeal sensation communicated to the præcordia and neighbouring parts from the brain, in consequence of the impressions made on it by the ideas: hence the conclusion to which we come, namely, that mental impressions act upon the nervous system, and rouse or depress the vital energies according to circumstances. The corporeal pleasure, when it is produced, tends to disengage the attention from pain previously existing; and, on this account, many mental impressions operate in relieving pain as effectually as substantial anodynes. Let us enquire in what manner this is produced.

Music.—If we select *Music* as illustrative of the manner in which these operate, we find that the first effect of its impression is that of an excitant; it rouses the attention: but the repetition of the impression at length exhausts, in the same manner as the repetition of any series of stimulant impressions, and sleep is induced. It may, however, be supposed that the Music, operating upon the auditory nerves, can scarcely be regarded as a Narcotic: and, assuredly, simple sounds, unless so combined as to produce agreeable emotions sufficiently powerful to withdraw the attention of the sufferer from the train of morbid associations which characterize his disease, are followed by no anodyne nor soporific effect. In this respect, therefore, although the primary impression be made upon a corporeal organ, yet the secondary influence is mental. It must, however, be recollected that it is not the mere succession of sounds that causes this effect, but the repetition of the same combination of sounds or impressions. Were the sounds much varied, the opposite effect would result; they would operate like new impressions, and each would renew the excitement; for it is a well-known law of the system, that a variation of a stimulant impression renews the excitement, in such a manner, as to be much less likely to be followed by collapse than when there is a repetition of the same impression. To illustrate this, I need only refer to the effect of listening to the gurgle of the mimic cataract of some mountain rill; or to that of any small waterfall: how decidedly is felt the influence of the monotony of the sound gradually disposing to sleep. It is a common observation, that a dull sermon is a good soporific: but it is less the matter of the sermon than the monotony of its delivery, which closes our eyes. Now Music operates in the first instance in this manner: in the second, by the associations which it engenders. If the music be slow and plaintive, the impressions are longer continued, less varied than animated strains, and therefore it is this description of music which is most soporific. The influence of all depressing passions is sedative; and the melancholy, which is the effect of plaintive music, is one

of these. This power of Music is much increased, also, by the period of the day, and the situation in which the listeners are placed.

> *Lorenzo.* ——— soft stillness and the night
> Become the touches of sweet harmony.
> *Jess.* I'm never merry when I hear sweet music.
> *Lor.* The reason is, your spirits are attentive*.

Upon the whole, the physiological influence of Music as a narcotic is well ascertained.

Friction.—The effects of gentle and slow Friction in producing a hypnotic result are referrible to the same principle, the repetition of an agreeable impression on the nervous system. I have witnessed the powerful influence of gentle friction in producing sleep in many instances. In painful affections, in particular, gentle friction operates as an anodyne, and produces a considerably soothing effect, by transferring the attention from the seat of the pain to the mild and agreeable impression of the friction. It is amusing to reflect that this imponderable narcotic admits of combination. Sound, as a hypnotic, operates, as I have already stated, with less energy alone; and this is the case with friction, which is most powerful when it is joined with sound: for although sound operates on a distinct sense, yet, the combination of the two is powerfully soporific: thus, the patting of an infant on the back, whilst at the same time the nurse hums a monotonous tune, is almost sure to procure sleep.

THERAPEUTICAL EMPLOYMENT OF NARCOTICS.

The diseases for which this class of medicines are peculiarly indicated may be arranged under three heads:

1. Nervous diseases.
2. Diseases arising from irritation of tissues.
3. Fevers, or diseases, of the vascular system.

1. In the *first class*, some of the diseases are merely partially benefited by narcotics; others depend chiefly upon them for their cure. Among the first we find *Epilepsy*, the symptoms of which are more or less convulsive; usually accompanied with loss of sense, of longer or shorter duration, in which the respiration is occasionally, but not always, stertorous. The parts affected are supplied chiefly by the nerves of the encephalon; and as the functions of the brain suffer extremely, both during and after the paroxysm, there is every reason for referring these convulsions, whatever the exciting cause may be, to the brain. It is scarcely requisite to say, that, under such a condition of the

* Merchant of Venice.

system, Narcotics can only be employed in cases depending on visceral or other irritations, to break the diseased habit, which produces a secondary effect on the brain. It is in that form of disease which has been named *Epilepsia uterina*, from the attacks preceding the monthly period, or accompanying it, that Narcotics have been found most beneficial. In such cases, a large dose of Opium, administered after venæsection, and when the bowels have been freely purged, often breaks the catenation of diseased associations, and at once removes the disease. In idiopathic epilepsy, no advantage is derived from the employment of narcotics.

In *Tetanus*, the irritation is correctly referred to the spinal marrow, when the disease is not symptomatic of wounds, nor idiopathic. This fact has been proved, not only by dissections of the bodies of persons who have died of this form of Tetanus, but, also, from remarking the influence of some irritants that exert their power chiefly on the motor tract of the spinal cord; as, for example, Strychnia, and the vegetable bodies containing it. It may be, in fact, regarded as a disease of the motor or voluntary nerves, affected by inflammation or irritation operating upon those parts of the brain and the spinal marrow with which they are connected. Opium, in such cases, is a remedy of great power. It should be early administered, as the progress of the attacks is generally rapid, and because the power of deglutition may be soon lost. The extent to which it may be administered, in this complaint, is only limited by its effects: many ounces of the Tincture of Opium have been taken with impunity before its influence on the disease was displayed. In this affection, the stimulant power of the narcotic quickly disappears; on which account, after the spasms are controlled by it, the use of it should be very gradually discontinued. A case is recorded by Donald Monro, in which 120 grains of solid opium were given in one day to a patient who had never before taken the drug, without any deleterious effect: thirty grains have been given daily for seventeen days successively; and twenty grains have been administered every third hour, in combination with aromatics, for several days, without producing any sedative influence on the habit. Twelve fluid ounces of the Tincture have also been given in the space of twenty-four hours; and Murray details the case of a man who was cured, after having taken twenty ounces daily of the Tincture, for many successive days; yet neither sleep, nor the resolution of the spasm, was produced until the last day of taking it*. Littleton cured Tetanus in two children of ten years of age, after giving to one of them an ounce of the officinal tincture in one day; and to the other, fourteen drachms of the Extract of Opium in twelve hours. In

* Practical Remarks on West India Diseases, p 106, quoted in Appar. Medicam. vol. ii, p. 325. The same author quotes several other instances of enormous doses having been administered with impunity in Tetanus.

these cases, recovery followed; and it is not assuming too much to ascribe the beneficial terminations of them to the influence of the narcotic. In general, the dose in the first instance should be moderate; namely, twelve or fourteen minims; and it should be repeated at intervals of an hour: but if no relaxation of the spasm take place in three or four hours, the dose should then be doubled, and so on progressively until the expected relief be obtained, or until symptoms of narcotism display themselves; after which, the dose should be gradually diminished: but no intermission should be permitted whilst the spasms remain. If deglutition be impeded, the opium, or the salt of morphia, may be administered per anum; or a concentrated solution of it in oil may be rubbed upon the spine; or a blister may be rapidly formed by a jet of steam directed on the part, and the denuded surface dressed with acetate of morphia. The agency of narcotics in this disease is often effectually resisted; and, even under every circumstance, they are not to be solely relied upon; but require to be variously combined with purgatives, antispasmodics, and tonics, as the individual case may demand. That they exert a direct influence on the nerves is evident, from their power, which has been frequently witnessed, of resolving the spasm of Trismus, lock-jaw, when the Tincture of Opium, or the oily solution of the drug, is rubbed on the jaw. Much depends on the pertinacity with which the narcotics are administered: and, from the extent to which they may be carried, it is evident that our expectations should not be damped, although little advantage may immediately result after the administration of the largest doses.

A physician of Montreal, in Canada, has successfully combined the employment of the cold affusion with opium, in Tetanus. The affusion is carried to syncope, after which the patient is rolled in dry, warm blankets, and a large dose of the wine of opium administered to him: if no resolution of the spasm soon takes place, this practice is repeated until it does, which generally occurs.

In *Chorea,* another disease in which every voluntary muscle of the body is liable to be affected, the influence of narcotics has frequently proved beneficial. The disease consists of an irregular, catching motion, occurring especially when the muscles are thrown into action by the power of the will: causing gesticulations that sometimes assume the most ludicrous appearance, and almost appear as if intended, like those of a mountebank, to excite the risibility of bystanders. The head, the trunk of the body, and the limbs, are, at different times and in different instances, affected: the patient cannot walk steadily; his gait resembles a jerking movement; sometimes the limbs seem as if palsied; and the arms cannot perform steadily any of the common and necessary motions. These irregular movements, however, cease altogether in sleep. The disease seem to depend on some

peculiar condition of the cerebro-spinal centres: but whether this is a state of excessive impulse of blood in these organs, it is difficult to determine, although its aggravation by whatever suddenly increases the action of the heart, affords some colour to this view of the subject. It is, nevertheless, true that bleeding has in no cases been followed by benefit; on the contrary, it has in general proved prejudicial; whilst it is equally true that the disease frequently yields to a tonic plan of treatment. On this account, the most correct idea of the state of habit which induces Chorea, is that which refers it to a morbidly excitable state of the nervous system, acted upon by some irritating cause. The narcotics that have been chiefly found beneficial in Chorea are *Belladonna*, *Foxglove*, and *Conium*. Sydenham* employed opium, after bleeding and active purging; and frequently, in cases complicated with Hysteria, it proved useful. An unusually severe case is recorded by Mr. Patterson, which occurred in the Bristol Infirmary, in which a complete cure was effected by opium and camphor; and we have, also, the authority of Cullen in favour of opium in this disease. The use of Belladonna, in the form of extract, administered in doses of one sixth or one fourth of a grain every sixth hour, was introduced by Stoll, and has frequently fully answered the intentions of the prescriber; but I must acknowledge that my own experience does not permit me to place much confidence in narcotics, unless as auxiliaries to other and more efficient remedies.

Chorea is one of those diseases in which mental narcotics have sometimes been found useful. The late Dr. Armstrong witnessed a case in which music had the power of procuring sleep, and of ultimately curing the disease, after it had resisted purgatives, tonics, and other medicines. Perhaps this may depend on the attention being abstracted from the affected muscles; for there can be no doubt that the motions characteristic of the disease are partly voluntary, and often continued from habit.

Narcotics have been found of little benefit in *Hysteria*, except in those cases in which the symptoms of Phrenitis are simulated, in which they have been found beneficial, in conjunction with rest, quiet, and a course of purgatives.

In *Asthma*, particularly that variety of the disease which is denominated *Spasmodic* asthma, narcotics are particularly indicated. Various opinions are held by different writers regarding the seat of the spasm in this distressing affection. I am disposed to coincide with Willis, Hoffman, and Cullen, that it is on the muscular fibres of the bronchi, or rather the bronchial cells, that the spasm is chiefly exerted. In a practical point of view, this fact would not much aid us in our treatment of the disease, were other morbid conditions, both general and local, which

* Opera Universa, ed. tertia, p. 495—6.

precede, or are co-existent with, this condition of the bronchi overlooked. This spasmodic affection, however, of these important organs are the great object of the practitioner to relieve during the paroxysm. It is curious to observe, that, notwithstanding the certainty of the spasmodic state of the bronchi, opium and other narcotics, with a very few exceptions, and even the most powerful antispasmodics, have often failed to afford relief; and, on the contrary, have not unfrequently proved injurious. This, however, depends upon the condition of the bronchial membrane at the time; and, although it be not positively inflammatory, yet, if the stricture depend on irritation of the parts approaching to an inflammatory character, no advantage can result from the use of narcotics until this condition is removed by remedies of another class. It is only in cases of pure nervous or spasmodic asthma, that opium and other narcotics are likely to prove useful; and it is only in such cases that they ought to be prescribed. The effect of Ether, in large doses, namely f℥i to f℥ii, in the height of the paroxysm, has been too often observed to be overlooked. I have found it productive of the greatest comfort to the patient; but its influence is transitory. The narcotic which excited the highest hopes in Asthma, at one time, is Stramonium. Its influence in resolving spasm, when administered in the form of Extract, was well known to Störk and some of the older physicians; but its value as a remedy in asthma, when smoked, was not known in England until the beginning of the present century. It is smoked in the same manner as tobacco, during the paroxysm; its most common immediate effects are a sensation of heat in the chest, followed by expectoration, slight vertigo or drowsiness, and occasionally nausea. In some instances, the utmost comfort is almost instantaneously obtained, the constriction of the chest is resolved in a few minutes, and the patient gradually drops into a refreshing slumber. Such are the effects of this narcotic, which I have often witnessed; but I must acknowledge that, in other cases, it has not only failed to relieve the dyspnœa, but it has even aggravated it. Why Stramonium has now fallen into disuse, I cannot explain, unless we ascribe it to the exaggerated hopes of its powers which were at one time entertained. It, however, still may maintain its place as one of the best remedies that can be employed during the asthmatic paroxysm. Sometimes, instead of being used alone, the Stramonium is mixed with Tobacco, or with Hyoscyamus, which displays nearly similar effects when smoked.

The watery Extract of opium, prepared by the Chinese under the name *Chandoo*, for the purpose of smoking, might be advantageously employed in the same manner as Stramonium in spasmodic asthma. I have had no experience of its powers; but, looking at the soothing influence which it exerts when smoked

as a luxury, there is sufficient reason for supposing that it would prove useful in Spasmodic Asthma.

In another spasmodic disease affecting the respiratory organs, *Hooping-cough,* this class of remedies has been found highly beneficial. Much diversity of opinion has existed respecting the nature and seat of this disease: some referring it to irritation, affecting either the brain or some other part of the nervous system; the affection of the respiratory organs being altogether secondary; others, among whom we find Dr. Watt, Laennec, Dewess, and other distinguished names, consider it an inflammatory affection of the mucous membrane of the bronchial tubes. Dr. Dawson confines the inflammatory action to the membrane of the larynx, or rather the glottis; and a fourth set regard the disease as inflammatory in the first instance, and afterwards spasmodic. Desruelles teaches that it consists of an inflammation of the bronchi, with irritation of the brain, the bronchial affection always being primary, the cerebral irritation consecutive. It is certainly on something like the latter view that the disease has been usually treated. It is in the secondary stage of the disease, however, that narcotics produce a salutary effect; and still more when the disease is kept up by the force of habit. Opium and Conium, in combination with Ipecacuanha and Carbonate of Soda, have a high reputation. In young children, the Opium should be given in the form of Tincture, and the dose should not exceed a minim. The operation appears to be antispasmodic and diaphoretic: the paroxysms lessen both in violence and in frequency. I have found more benefit, in the irritative stage of the disease, from Belladonna, given in doses of the eighth of a grain, combined with the same quantity of the aqueous extract of opium, and six grains of powder of valerian. The dose of the Belladonna should be gradually increased, until the sight be slightly obscured, and a scarlet eruption overspreads the skin, very similar to that of Scarlatina, accompanied with some degree of headache. In this case, the Belladonna appears to act as an irritant on the cutaneous capillaries, and to produce a counter-irritant effect, whilst its sedative influence is felt on the bronchi, in the muscular coat of which the spasm is excited; and this is the more probable, as the cough ceases as long as the eruption continues, and sometimes reappears as it declines.

The necessity of allaying morbid sensibility, and abating that mobility of the muscular system which greatly increases the length and frequency of the cough in *Chronic Bronchitis,* points out the propriety of the employment of Narcotics. Opium, however, is supposed to be of doubtful efficacy, on account of the local congestion which it is apt to produce. The salts of Morphia, in combination with *Squill* and *Ipecacuanha,* are generally preferred. In my own practice, I have been much in the habit of ordering Conium. If the Extract be good, the dose, at first, may be from three to five grains, to an adult; but it should be

gradually increased until it produce giddiness, tremor, or nausea, and some feeling of tension in the head. Henbane is equally useful; and Belladonna is still more so when dyspnœa is urgent. The Tincture of Digitalis, also, may be administered with the same view, commencing with ten or fifteen minims, and gradually raising the dose.

As far as my own experience extends, however, no narcotics have proved so beneficial in chronic Bronchitis as the Salts of Morphia, applied upon a blistered surface. The same effects are produced as when these salts are taken into the stomach; but they are displayed more rapidly and with more energy. It is of little consequence whether, in this case, absorption takes place from the denuded surface, or the influence is exerted through the nerves: the beneficial effect is undoubted. One effect of the endermic application of the salts of Morphia is an eruption closely resembling Eczema, which extends over the greater part of the body: its appearance is always followed by benefit to the chest; it is often the precursor of a complete cure. In administering narcotics, however, in chronic Bronchitis, we must recollect that the cough is often essential for clearing the bronchial cells, and, therefore, it should not be incautiously checked.

Whatever may be the original cause of *Insanity*, whether the condition of the brain, on which it is dependent, be that of inflammation, or something nearly allied to it, there can be no doubt that the more advanced or chronic stage of the disease is that in which Narcotics are indicated. The object of the practitioner in this disease is to restore and maintain a healthy condition of the physical or natural functions, and to obviate diseased actions in other parts of the system, which may tend to keep up the morbid condition of the brain. The mode of treatment, consequently, requires to be varied according to the constitution and the modifications of disease which each particular case may present: but still there are some circumstances in common adapted to all.

In a general point of view, Narcotics are not indicated in diseases of the mind; occasionally, however, they have proved decidedly beneficial; but much depends on the form which the disease assumes. In Melancholia, notwithstanding the restlessness, and painful sensations which attend it, Opium, unless given in very large doses, rarely procures refreshing sleep; and as indirect debility usually follows such doses, the consequences are more hurtful than the temporary tranquillity thus procured is salutary. Nevertheless, large doses of laudanum have occasionally proved of the utmost benefit. Cases are recorded in which fifteen grains have been given for a dose*; and Mr. Hill states, that four hundred drops of the Tincture have been taken as

* Wepfer, Hist. Apopl. in App. p. 687.

a dose, and followed by beneficial effects*; but these are to be regarded as rare instances, and viewed rather as another proof of the resistance of the habit, in particular states of the nervous system, to the influence of narcotics, than as affording a well-grounded example for others to follow. In female subjects, who indicate great susceptibility of impression, with an hysterical diathesis, when, along with Insanity, they suffer from severe palpitation of the heart, depressing languors, and considerable muscular debility, Opium may be given with advantage.

In Mania, again, when all febrile heat and turgescence of countenance have been subdued, Opium is generally beneficial; especially where the mind remains defective through debility, and is prone to dwell on real or imaginary misfortunes, and contemplates suicide. In two cases mentioned by Dr. Hodgkins, in which there was a strong propensity to suicide, a large dose of Opium was productive of sound sleep, and was soon followed by a restoration to health. These remarks, of course, apply to all the salts of Morphia. In choosing amongst these, however, the Acetate is to be preferred, on account of its determination to the surface being greater than that of the other salts of Morphia. Whichever is selected, the dose should be large. In that peculiar species of insanity which arises from the abuse of alcoholic liquors, it is advantageously combined with camphor.

Many practitioners prefer Hyoscyamus to opium, in every form of Insanity. It certainly has some advantages over opium: it does not confine the bowels, nor excite morning headache, nor favour the cerebral congestion, which is almost always the result of the administration of Opium. It generally produces tranquil sleep, succeeded by serenity, mitigation or removal of pain, gentle morning diaphoresis, and a solution of the bowels, which is a most desirable event in every case of asthenic Insanity. It is often combined with Camphor, which, in itself, possesses anodyne and hypnotic properties: but which, nevertheless, on account of the depressing influence which it exerts, does not improve the action of the Henbane in maniacal affections. It has been properly remarked, by Dr. Halleran, that Insanity is not phrenitis; and he also remarks that the pulse in the most furious maniacs, when under the influence of Camphor, falls so low as 50, without being accompanied or followed by the smallest diminution of their general sufferings. By the duration of such a state, he continues, the countenance eventually assumes a livid aspect, the extremities become cold and insensible, the arterial blood is concentrated in the trunks, the action of the lungs is impeded, and congestion of the brain is often the inevitable consequence. Nevertheless, Dr. Perfect relied on it in Insanity, and illustrated his opinions by details of one hundred and three

* Essay on the Prevention and Cure of Insanity, p. 348.

cases, in which it produced essential benefit. He gave it in doses of two scruples, night and morning. In *Nymphomania*, a disease depending on a morbidly sensible condition of the uterus and its appendages, Camphor has been found beneficial, after bleeding and evacuations. The dose of Henbane in Mania, when the Extract is employed, ranges from ten grains up to sixty; and its combination with Musk renders it still more valuable when the disease has been either brought on or is aggravated by terror, or any sudden and powerful mental shock. Tissot*, and several other writers, however, condemn the use of Henbane in Mania.

Digitalis, in general, is regarded rather as a sedative than a narcotic; but its primary stimulant influence is undoubted, its sedative power is secondary; and, in many respects, its effects closely resemble those which result from Opium; but it produces them free from the unfavourable consequences that Opium too frequently occasions. On account of its stimulant property, however, it ought not to be administered when the system is under the pressure of high arterial action; a fact also which holds good in the treatment of dropsy by it. In all cases of relaxed fibre, it operates with peculiar efficacy; and from this observation we learn the propriety of taking preparatory measures of depletion, without which it is not only inapplicable, but decidedly hurtful. Dr. Halleran, who introduced the use of Digitalis as a narcotic in Mania, prefers the saturated Tincture, made with recently dried leaves, collected in June, in dry, warm weather, and dried without heat. He gives it, at first, in doses of ten drops in a glass of water, three times a day, increasing the dose gradually to twenty; then, after pausing a few days, raising it to thirty; then, pausing again, and afterwards carrying it to the extent to which the patient can bear it, or sleep is procured. In this manner, Dr. Halleran has carried the dose to one hundred drops, with safety and advantage†. I have frequently carried it to sixty and eighty minims, with no other result than the production of sleep, quiet, and the restoration of the health and intellect of the patient. In one case, the accompanying symptoms were rather remarkable; but the patient, an old lady, remained in excellent health for upwards of twelve years.

M. Foville recommends the use of Foxglove in Mania to be limited to those cases in which the disorder of the brain co-exists with increased action of the heart, and particularly with increased fulness and plethora of the carotid and temporal arteries—a practice in opposition to my theory of the action of Foxglove.

In Mania, there is a degree of torpor of the brain and the nervous system, which the primary stimulant power of the Fox-

* Traité de Epilep. p. 364.

† Practical Obs. on Insanity, by W. S. Hallaran, M.D. 2nd edit. p. 98—112.

glove influences, whilst its secondary sedative power is well calculated to allay irritation, subduing arterial action, and promoting the most refreshing sleep. "By the almost insensible action of Digitalis only," says Dr. Halleran, "can we expect to meet its bad effects; and its injurious administration may generally be rated according to the sudden and decided evidence of its power over the vital organs*.

In another species of delirium closely bordering on Insanity, *Delirium Tremens*, the influence of opium as a salutary agent is well established. This disease is generally the consequence of an abuse of spiritnous liquors; and, notwithstanding the high state of the delirium, it does not admit of blood-letting or much depletion by any other means. Opium, in this case, is our chief remedy; but it is requisite to avoid over-dosing it; on the contrary, the most benefit results from small doses repeated at short intervals. Much advantage is derived from its stimulant influence, as well as from its sedative power; and, although we are too little acquainted with the real pathology of the disease to be able to give a satisfactory account of the mode in which it operates, yet, experience has firmly established the value of opium in this disease. With regard to the dose, if the officinal Tincture be employed, or Battley's Sedative Solution, and it is advisable to administer the narcotic in the fluid rather than in the solid form, ten minims may be given every hour in an effervescing draught; and, if no nausea be present, a few drops of Hoffman's Anodyne may be added to it.

In all *painful affections of the nervous system*, Narcotics exert a powerful anodyne influence, and are the chief sources of relief. One of the most severe of these diseases is *Neuralgia*. It consists of a severe, sharp, sudden, plunging pain, in some particular spot, unaccompanied by an apparent inflammation. The pain intermits, but is instantaneously induced by any thing that excites the most moderate movement in the part. The pain is often almost insupportable, and has arisen to a height sufficient to cause delirium. Its most frequent seat is the first or second ramifications of the fifth pair of nerves; but it occasionally attacks other nerves.

Dr. Parry is of opinion that this disease depends on increased vascularity, or determination of blood to the neurilema, or vascular envelopes of these nerves. He founds this opinion chiefly on the fact that the complaint extends itself to the "branches of more than one nerve in the same patient, which could only happen through the medium of blood vessels; since there is no evidence to prove the extension of pain, by pure sympathy, to anastomosing branches of nerves derived from different trunks†."

* l. c. p. 113.

† Elements of Pathology and Therapeutics, p. 366.

There is reason, however, to doubt this explanation, as the abstraction of blood affords no relief.

Opium, Belladonna, and Stramonium, were, at one time, in combination with purgatives, the agents on which the greatest dependence was placed for obtaining relief; and even now, when an almost specific has been discovered in Carbonate of Iron, these narcotics are still powerful auxiliaries in the treatment of the disease. Belladonna in particular, when applied as a plaster to the pained spot, very frequently sooths the pains, and affords all the temporary benefit that can be desired, until the general and more permanent salutary influence be obtained from other remedies. Opiate frictions are, also, calculated to allay pain: they do not always procure sleep, but they calm the exaltation of the nervous system, and procure for the patient that repose from suffering which he requires.

In the *second class* of diseases, those depending on irritations affecting the tissues, narcotics are prescribed with the view of soothing morbid sensibility; and consequently those which possess anodyne properties are to be selected for this class of diseases.

In some varieties of *Dyspepsia*, particularly that variety which is connected with an affection of the mucous follicules, and is characterized by pain, nausea, cramp, a sensation of weight, gnawing, or some uneasiness, in the stomach when the organ is empty, and vomiting of an insipid, viscid, nearly pellucid fluid occurs, much advantage is derived from Astringents and Narcotics, although they should not be combined or administered at the same moment. As diarrhœa is usually present, gr. x of kino may be taken once in four or five hours, and, in the interval, from gr. ¼ to gr. ss of opium in a pill. In some cases, when the stomach is very irritable and the vomiting severe, after the administration of gr. vi to gr. x of calomel at once, a larger dose of the watery extract of opium may be given in the same manner as the crude opium. As the irritability decreases and the stomach regains its natural function, the periods between the doses of the narcotic should be lengthened, and a tonic prescribed. I have seen cases which have owed every thing to the narcotic, and in which every form of tonic did harm. It is indeed the anodyne property of the narcotic exerted on the nerves of the mucous tissue in particular, diminishing the morbid susceptibility of sensation, which is the chief source of the benefit.

In another painful affection, closely resembling that which I have just alluded to, *Pyrosis*, Narcotics have also been regarded as our sheet-anchor; but the necessity for their use is more problematical than in the former instance. The pain in Pyrosis arises from the contractile efforts of the muscular fibres of the stomach being forcibly exerted, excited by the diseased secretions of the organ itself. Now, to endeavour to overcome this by narcotics

without removing the offending cause, is ineffectual practice. When Opium is trusted to in order to subdue this pain, it requires to be increased in quantity after short periods; and a habit is thus acquired under which the general system greatly suffers. Dr. Barlow, whose opinions accord with those which I have just stated, says that two hundred and sixty drops of laudanum are often attained to, without permanent benefit, in this complaint: the only value of narcotics, therefore, is to afford occasional prompt relief, when the pain is very severe, not to supersede the employment of other remedies. I have seen much benefit derived from a combination of alkaline medicines and extract of Hops, in this painful affection.

In *Colic*, the combination of narcotics and purgatives is indicated; the former removes resistance to the action of the latter, by resolving spasmodic contractions in the muscular coat of the intestinal canal: the combination of Castor Oil, or Croton Oil and the Compound Tincture of Camphor, is well adapted for this purpose. When the spasm resists these means, the Tobacco enema, made with a smaller than usual quantity of the Tobacco, namely, gr. xv to f℥viii of water, has been found extremely serviceable. In this strength, it operates as a narcotic, displaying both an excitant and a sedative influence. Nothing, however, relieves the pain in colic equal to opium or the salts of morphia, if they be administered after blood-letting: but, unless in paroxysms of severe tormina, the narcotic should always be united with a purgative. Its external application to the abdomen is often productive of much ease; a proof, if any were wanting, that narcotics are not always taken into the habit when their influence is conspicuous. The same beneficial effects of narcotics have been anticipated in Colic arising from the poison of Carbonate of Lead; but, as the poisonous agent, in this case, operates as a powerful sedative, it might be supposed that it is scarcely rational to endeavour to overcome it by narcotics. When the pain, however, is severe, the external application of opium proves useful; but I have rarely seen a case in which its internal administration was indicated.

In another painful affection connected with the digestive organs, *Gall-stones*, the value of Narcotics is unquestionable. The formation of these calculi is involved in obscurity; but after they are formed, whatever disturbs the function of the stomach, and causes a sudden evolution of flatus, either in the organ itself or in the colon, pressing on the fundus of the gall-bladder, pushes one or more of them into the duct; and if the size be great, or if, from the form of the calculus, irritation be excited, contraction takes place; and, the nerves of the stomach sympathizing with those of the spinal marrow connected with the muscles concerned in the action of vomiting, pain and repeated vomiting vex and wear down the patient. The object, in this case, is to facilitate the passage of the calculus, by resolving

the spasm, to mitigate pain, and to guard against inflammation being set up in the parts. For fulfilling the two first indications, Narcotics, especially opium and the salts of morphia, are admirably adapted. If the pain be severe, the first dose should be large, from two to three grains of Opium, or half a grain of Hydrochlorate or Sulphate of Morphia; and if the pain do not abate, this dose may be repeated every hour; and, afterwards, at shorter intervals, until ease be procured. As in tetanus, the pain, in this disease, operates as a resisting power against the narcotism of opium; and the only rule for the quantity that may be administered, is the effect produced in relieving the sufferings of the patient. I have given five hundred drops of laudanum before this result was obtained, without any deleterious consequences following so large a quantity, in a habit unaccustomed to its use. The same reasoning applies to the employment of narcotics for resolving spasm and abating pain during the passage of *renal calculi*, through the ureters, from the pelvis of the kidney. In this case, however, owing to the advantages derived from contiguity, the Opium operates most beneficially when it is exhibited per anum, dissolved in oil. Mr. Brande recommends Henbane for allaying the irritation caused by the presence of the lithic acid in the kidneys. In other painful affections of the urinary organs, whether connected with a diseased condition of the prostate gland, or arising from calculi irritating the bladder, or from the irritation of the erectile tissue in Gonorrhœa, Narcotics are equally useful, and form our chief sources of relief. If Opium, or the salts of Morphia, be employed, their narcotic influence is both augmented and rendered more permanent by the addition of Calomel. Neither large doses of opium alone, nor large doses of calomel alone, produce the immediate relief derived from the combination of these medicines.

In *Diabetes Mellitus*, a disease in which the urinary secretion is greatly altered both in quality and in quantity, Narcotics have also been productive of benefit; at least, as far as the diminishing the quantity of the secretion can be regarded as beneficial. Notwithstanding the rapid strides which have been made in physiological and chemical knowledge, however, the pathology of this disease is still involved in much mystery. In particular, the information derived from anatomy is very unsatisfactory; and, although the urine has been examined, and the changed state of it fully elucidated, yet the causes of the change, or the essential pathology of the disease, is not understood. With the view of diminishing the general irritability of the system, always great in Diabetes, the narcotic power of opium has been resorted to; and, also, with the hope of lessening the secretion of the kidneys, by augmenting the cuticular exhalation. It has even been supposed to moderate, and even to remove the saccharine quality of the urine; a fact which was

strikingly illustrated in a case treated by Dr. Warren*. It is usual to commence with small doses three or four times a day, and gradually to augment the dose to five or six grains. "All the beneficial effects to be expected from opium," says Dr. Prout, "may in most instances be obtained from moderate doses; and when thus judiciously exhibited; and when no peculiarity of constitution forbids its use, I believe that it will be found one of the most powerful remedies that we possess in this disease." This opinion accords with my own experience: indeed, I have never had occasion to carry the dose to the extent to which it has been raised by Dr. Elliotson. The acetate of Morphia, in full doses, may be advantageously substituted for opium, as it greatly favours perspiration and calms irritation, without the uneasiness of head, and the constipation which always, more or less, follow the administration of opium.

We have now to examine the *third class* of diseases in which Narcotics are indicated; namely, those usually known under the term fevers, and those in which the sanguiferous system is morbidly excited. In prefacing our observations upon the therapeutical influence of narcotics in these affections, it is necessary to remark that the nature of the narcotic action precludes their administration in all cases of actual inflammatory excitement, until after the use of the lancet, or other active and efficient depleting measures, have been resorted to. When used before the force of the circulation has been lowered, Narcotics augment the heat of the skin, increase the morbid action of the arterial system, determine a flow of blood to, and its stagnation in the capillaries, and especially in the part suffering most from the general inflammatory condition of the habit. Thus, in inflammation of the brain, or its meninges, the excitement which Narcotics carries, as it were, into the diseased organ, augments the congestion already existing there, and is productive of the most dangerous consequences.

In the treatment of general fever, when Narcotics are indicated, we must keep in view both their stimulant and their sedative powers; and in those cases, or in those periods of fever, in which stimulus would prove injurious, whilst a sedative power is required, we ought not to administer them until the previous excitement is subdued by blood-letting, or by other means. In fevers, Narcotics have been administered with two intentions: 1, to operate as excitants when the vital powers are sinking; 2, to tranquillize the nervous system and to procure sleep. The former intention is now seldom desired, as other and better excitants are in our hands. The second is more important, and is still attended to.

In fevers of an inflammatory type, or such as attend local

* Med. Trans. of the Roy. Coll. of Physicians, vol. iv.

inflammation, Narcotics prove beneficial, if administered in full doses immediately after blood-letting; but, without this prefatory measure, they are contraindicated. As an antiphlogistic, Opium combined with Calomel, in the manner I have described, was most successful in the hands of Dr. Hamilton, of Lynn-Regis*; and in the practice of the late Dr. Armstrong†. In *puerperal fever*, the value of narcotics cannot be doubted‡.

In *intermittent fever*, Opium has formed a remedy from the earliest period of the healing art§. It has been administered, with various success, both during the paroxysms and in the intervals; a practice which originated with Paracelsus, and was practised by Etmuller, Wedel, and others, as well as Sydenham; but they gave it at the accession of the paroxysm. So early as the time of Galen, it was employed as an antiperiodic; and, in some part of Europe, this practice is still followed in conjunction with tartar emetic: but, although Narcotics aid the power of other antiperiodics, yet the experience of British practitioners is not in favour of the uncombined power of Opium in this respect. The best period for administering Narcotics in ague, is that strongly recommended by Sydenham, namely, two hours before the expected paroxysm‖. At this time, a full dose of opium weakens the force of the attack, if it does not altogether prevent it: a result probably due to its excitant property. Lind¶ and Dr. Odier** ordered it half an hour after the commencement of the hot stage, with the view of hastening the sweating stage, and, consequently, shortening the paroxysm. The dose should be large, from forty to sixty minims of the Tincture. Several practitioners prefer combining it with Sudorifics; namely, Ipecacuanha, Tartar emetic, or Hydrochlorate of Ammonia: but little advantage is thus obtained. The practical value of this employment of opium is well known; and did it require any illustration, nothing would more strongly display its power than the fact that, in the Peninsular hospitals, during the last war, when ague prevailed, the soldiers applied for an ague-draught, which consisted of 60 minims of Tincture of Opium and one fluid drachm of Ether, whenever they saw their nails turning blue, which they had learned to know was the commencing sign of the paroxysm††. As it tends to excite the cutaneous functions, Lind's mode of administering it during the hot stage is attended with no disadvantage, except in plethoric habits, and in cases displaying a tendency to inflammation. It renders the hot stage shorter and milder, and also extends the duration of the intervals or intermissions, and greatly favours the influence of Bark and

* Edin. Med. Comment. ix, p. 191. † Trans. of Assoc. Apoth. 1823.
‡ Ferguson's Essays on the Diseases of Women, 1839.
§ Schulz. Dissert. de Intermitt. curationibus antiquis.
‖ Opera Universa. 3tia edit. 1705, p. 60. ¶ Diss. on Hot Climates, p. 316.
** Medical Comment. vol. vi, p. 351. †† Hennen's Obs. on Military Surgery.

the salts of Quina. In obstinate tertians, it is a most useful adjunct to calomel, in doses of a grain, taken at bed time. Cases which resisted both Bark and the salts of Quina and Arsenic, have soon yielded to these remedies after the administration of a grain of Calomel and of Opium, at bed time, for a few successive nights. Dr. Clark* states that he found Opium most useful in the remittent and intermittent fevers of Bengal; and not less so in continued fevers of the same climate. In the former, it promotes quietude, sleep, and favours perspiration; in the latter, it rouses the nervous energy, and prevents delirium. After full evacuations, Dr. Clark usually gave a large dose of Opium, as a preparation for the immediate use of Cinchona; and he continued the administration of Calomel and Opium at bed time, as an addition to the bark.

The efficacy of opium in intermittents is assuredly due to its excitant property, which, acting on the capillaries, prevents the congestion which takes place at the accession of the paroxysm: but, as the repetition of it tends to debilitate, it ought not to be given in successive paroxysms, if it fail to check the accession in the first paroxysm.

Many persons question the propriety of giving Opium in *Continued fever*: and it must be admitted, that, in the acute form of fever, it is of doubtful efficacy. If it be required to allay pain, or to procure sleep, it should be given in large doses, in conjunction with Calomel and Tartar emetic, which diminish its excitant property. If the temperature of the skin be high, unless there be a tendency to perspiration, it should not be administered in continued fever: when there is a tendency to perspiration, it accelerates the flow of the sweat, and proves beneficial. Dr. Currie employed it with advantage after the cold affusion. Dr. Stokes has proposed to administer opium in large doses when peritonitis occurs in fever from intestinal perforation. In such cases, the depleting or antiphlogistic plan of treatment is of no value; and it becomes a matter of great moment to support the sinking powers of the system. When alimentary matters pass through the perforations, this plan is more especially indicated, to aid Nature in repairing the evil. The object of giving the Opium is—1, to support the system; 2, to prevent further effusion into the peritoneal cavity. Solid Opium, in grain doses, or the black drop in doses of five minims, is recommended to be administered every second hour.

In the advanced stages of *Typhus*, Opium was formerly prescribed as an excitant, combined with Camphor and other cordials; but this practice is now discontinued. Camphor, however, is still prescribed in every kind of fever during the paroxysm or exacerbation, to allay irritation and procure sleep.

* Treatise on the Diseases of Long Voyages.

Cullen affirms that he employed it with advantage in nervous fevers attended with delirium and watchfulness: but, in this respect, it is inferior to Opium, the influence of which is not augmented by the Camphor. In mixed fever, or Synochus, it is difficult to fix upon the exact time for the administration of opium. In the first stage, the excitement is too considerable to admit of its use; and, if delirium be present, its administration is generally productive of severe headache. In the second stage, when debility supervenes, it proves useful; and it is at this period of the disease that it is recommended by Lind, Blane, and others. Under any circumstances, however, Opium is inferior to wine; and it is also less permanent in its effects. The chief symptoms which indicate its employment are diarrhœa, watchfulness, delirium, tremor, and subsultus tendinum. When delirium is present, however, it must be recollected that this condition of the brain may be the consequence of high cerebral excitement, as well as of debility; consequently it is important to distinguish between these states before Opium be prescribed. If, with delirium, the face be flushed, the eye be impatient of light, and the temples throb, Opium should not be given: but if the delirium be low and muttering, preceded by unusual inattention, then, combined with Ammonia, Opium is preferable to wine: it is, also, more useful when diarrhœa is present, and when the patient has been previously intemperate in his habits. The dose, however, should be small, and frequently repeated; and, at the same time, the apartment of the patient should be freely ventilated with cool air.

Watchfulness, when attended with heat of the surface, tossing in bed, with a sensation of rushing of blood to the head, and other symptoms of excitement, cannot be removed by Opium; but, if an opposite train of symptoms is present, then it is likely to prove beneficial; and it should be given in full doses, at a period later than the usual time of rest. It may be combined with Calomel; and cold applications to the scalp aid its soporific power.

The form in which Opium may be prescribed in continued fever is of less importance than an accurate knowledge of the circumstances under which it is likely to prove beneficial or hurtful. With respect to form, however; if the solid state be preferred, the Aqueous Extract is the best; or the Acetate, or the Sulphate, or the Hydrochlorate of Morphia may be employed: if the fluid form be required, then the officinal Tincture, the Black Drop, Sydenham's Liquid Laudanum, and the solution of the Hydrochlorate of Morphia (E.), are the best preparations. Many circumstances, some of which have been noticed, concur to vary the dose; but, as a general rule, when the stimulant influence of Opium is required, the dose should not exceed m. x, repeated every hour, or every two hours; when the anodyne influence is desired, the dose should be double that

which the patient, in a state of health, requires to produce sleep. The same rule holds good respecting doses of the other Narcotics in fevers of a continued kind. If Camphor be employed, the dose should be from fifteen to twenty grains; its efficacy is much augmented by the addition of a quarter of a grain of the Hydrochlorate or the Acetate of Morphia.

Inflammation, it is scarcely necessary to say, is both active and passive: in either, the object of every mode of treatment, in the early stage, is to procure resolution. In addition to blood-letting, and for maintaining the sedative effect which it produces, as well as to allay pain, nothing is so useful as Opium in combination with Calomel. The introducer of this practice, Dr. Hamilton of Lynn-Regis, regarded the combination of the Calomel with the Opium as most essential. In very irritable habits, however, Opium alone has been found salutary. After an ample bleeding, gr. ii of Extract of Opium have so controlled and tranquillized the heart's action, as to afford some refreshing sleep to the patient, to free him from pain, and, in many instances, to arrest at once the progress of the disease. In very irritable habits, when much blood has been lost, either by blood-letting or by hæmorrhage, a larger dose than usual, namely, four or five grains, has completely prevented any subsequent increase of the force or the frequency of the arterial action, or any recurrence of pain. This beneficial influence of Opium after blood-letting has been peculiarly demonstrated in the inflammation of serous membranes: nor has its efficacy been less conspicuous in controlling gastric inflammation; and even in phagedenic ulceration of the throat. Dr. Stokes, of Dublin, has given some interesting cases illustrative of this practice in his Clinical Observations on the Exhibition of Opium in Large Doses. The opportunities which he possesses for observing its effects have enabled him to draw the following conclusions:

1. That in cases of recent inflammation of serous and mucous membranes, where depletion by blood-letting or other antiphlogistic measures are inadmissible, and the system is in a state of collapse, the exhibition of opium has a powerful influence in controlling the disease.

2. That, under these circumstances, the remedy may be given in very large doses, with great benefit and safety.

3. That its effect, then, is to raise the powers of life, and to remove the local disease.

4. That the poisonous effects of opium are rarely perceived in those cases: the collapse and debility of the patient appearing to cause a tolerance of the remedy.

Although, as I have more than once remarked, Opium and all Narcotics are contraindicated during the existence of acute inflammation, yet, when pain becomes the most urgent indication, after it has resisted full depleting measures, the subjugation

of it must be attempted by Opium in full doses, repeated and augmented in quantity if the pain do not yield to two or three grain doses. But, although large doses of this narcotic are always well tolerated by the nervous system in this condition of the habit, yet, any injurious consequence should be guarded against by wrapping the head in a wet towel, or applying an evaporating lotion to the shaven scalp. In inflammation of the brain, however, scarcely any circumstances can justify the administration of Opium, nor indeed of any narcotic, until the inflammatory symptoms are overcome; and then, if the patient still remains watchful and restless, with a clean tongue, a cool, soft skin, and a quick pulse, a full dose of Opium is demanded.

Some of the consequences of inflammation, also, are frequently benefited by Narcotics. Thus, in gangrene, Opium is an invaluable remedy when judiciously administered: it sooths pain, abates restlessness and irritability, and procures sleep. It is, however, improper in the acute stage of mortification; but, when the excitement is subdued, it may be given in combination with Calomel, as in common inflammation. It is most especially indicated when spasm or convulsions arise during the progress of mortification. In that species of Gangrene which is termed *dry Gangrene*, and which commences in the fingers or the toes, and gradually extends to the arms and the limbs, a degree of inflammation which may be regarded as passive, Opium is our sheet-anchor.

It has been already stated that in inflammations of serous membranes Opium proves useful. In *Pleurisy*, the effects of the inflammatory action on the serous membrane produces such rapid and dangerous changes of organization, that whatever measures are adopted should be prompt and energetic. Besides the infiltration into the cellular tissue, and the loosening of the connection between this tissue and the serous membrane, the exhalation of the surfaces is either completely suspended, or it is changed in its character; and either a false membrane is formed, and adhesion takes place, or the inflammatory process terminates by effusion into the serous cavity of the thorax. To anticipate and to prevent these results, are the great objects of the practitioner. One of the means to attain this end is to procure the repose of the diseased organ, by quieting the irritation of the cough. With this view, Narcotics are indicated; and either Opium in large doses after a full bleeding, or Conium, or Lactucarium, may be employed. If the bowels have been freely opened, the beneficial influence of Narcotics is insured by the addition of tartar emetic, which tends to equallize the circulation.

When the inflammation is in the parenchyma of the lungs, constituting *Pneumonia*, Narcotics are useful auxiliaries to other remedies; the urgency of the cough demanding their employ-

ment. In a close examination of the pathology of the disease, we find that it is an inflammation extending over the system of pulmonary blood vessels; and that, however it may be supported, nervous irritation in these vessels exist; consequently, it bears in its effects a serious connection with the two most important functions of life, namely, *circulation* and *respiration*. After blood-letting, Calomel and Opium are advantageously administered: the latter acts as an *anodyne* in subduing pain, and as a *sedative* in quieting cough and relieving that nervous irritation which always tends, even after blood-letting, to re-establish the inflammation. After a full bleeding, when the pain is considerable, from a grain to two grains of Opium may be added to six grains of Calomel; but if the arterial action be still strong, one half only of this quantity of opium should be ordered, as the Calomel in this case is more valuable than the Opium: and it is even advisable to lower its stimulant property still more by adding Ipecacuanha or Tartar-emetic to it. The salts of Morphia may be substituted for the Opium. But, as in Pleurisy, Opium in large doses has been given immediately after blood-letting to syncope, and it has maintained the reduction which the bleeding effected. In its administration, we must always preserve in view the necessity of bleeding to syncope; for it is only in that case that the Opium seems to paralyze, as it were, those powers of reaction by which, after any moderate or temporary reduction, the inflammation is again rekindled. It is in the first stage of the disease that it is useful; and its utility is invariably increased by its combination with Calomel and Tartar-emetic. It is, also, more efficient in the fluid than the solid state, and from m. xx to m. xxx of the officinal tincture may be administered immediately after the bleeding, when much pain is present. The quantity of Opium should, in every instance, be sufficient to insure its sedative effect, especially when, by means of the depleting measures previously employed, the urgent symptoms are reduced to cough and the want of sleep. The other narcotics, Conium, Belladonna, Lactucarium, and Digitalis, may be administered under the same restrictions as Opium: they are less likely to prove injurious than the Opium when improperly used; but, at the same time, they prove much less efficacious. In an admirable Essay on this disease, by Dr. C. J. B. Williams*, we are informed that Digitalis possesses no anodyne properties; but I cannot easily conceive in what manner it produces soporific effects, if it is incapable of allaying pain. In the progress of the disease, especially if that state of lungs occur which resembles gangrene, the fœtor of the expectorated matter is considerable; and, in this case, a combination of

* Cyclopædia of Practical Med. art. Pneumonia.

Opium and Chloride of Lime, in the proportion of gr. i of the former to gr. iii of the latter, taken three times a day, has been found effectual for removing this fœtor.

In *Peripneumonia notha*—that state of pulmonary inflammation in which there is a greater flow of humors into the lungs than in ordinary Pneumonia,—both in that variety which constitutes the catarrhus suffocativus of old age, and that characterized by congestion in the pulmonary vessels, Narcotics are useful. In these cases, after a moderate bleeding, Opium, in combination with Ammoniacum, Squills, or other stimulants, has been productive of the greatest benefit. Opium, nevertheless, is said to suspend expectoration; let us, therefore, examine on what principles it relieves this variety of pulmonary disease.

In the first place—what is the condition of the chest? We find that the pain is greatly aggravated every time a full inspiration is attempted, and consequently it is seldom procured; and even this, imperfect as it is, is procured only when the patient is in a recumbent position. Now, in this state of the respiratory function, the necessary change of the blood cannot be effected; and as the bronchial membrane is in a highly irritable condition, the secretion is hurried, and the sputa are consequently thin and acrid. Under these circumstances, Opium taken into the stomach, by its influence on the pneumo-gastric nerves, and its power of abating pain, enables a fuller and more perfect inspiration to be obtained. It is thus easy to comprehend that, this producing more slowly secreted and better concocted mucus, the sputa will be more easily coughed up than a thinner and more irritating excretion. Hence, in this state, Opium, instead of retarding, promotes expectoration.

The advantages of Calomel and Opium are not striking in Pleurisy.

A modification of Peritonitis is seen in *Puerperal fever;* and here the same advantages from the Opium are obtained; indeed, when the symptoms do not indicate a very formidable attack, bleeding should not be carried too far; one general bleeding, followed by five grains of Dover's powder, with Cathartics, has been often sufficient to remove the disease.

Very little requires to be said respecting inflammatory diseases of the mucous membrane; Narcotics operate in these exactly in the same manner as in those of the serous cavities. In *Acute Bronchitis,* which is very often confounded both with Pleurisy and Pneumonia, Calomel and Opium combined, as in other acute inflammations, administered in frequently repeated doses, after bleeding, is highly beneficial. In the chronic form of the disease, M. Neuman of Berlin has found Digitalis an admirable remedy when the disease depends on a state of erethrism of the mucous membrane of the bron-

chial tubes. He infuses ℥ii of the dried leaves in f℥vi of boiling water, and gives a spoonful of this infusion every hour until nausea, or a sensation of constriction of the throat, or irregularity of pulse is produced. The use of the medicine is then suspended for a week, after which it is renewed if the disease be not removed.

When Bronchitis is complicated with Hepatic disease, the Opium should be in smaller proportion to the Calomel, and combined with Ipecacuanha, in the form of Dover's powder.

In affections of the heart, the utility of Narcotics has been questioned: but experience has confirmed the efficacy of one of them, namely, Foxglove, in Hypertrophy of the left ventricle, with or without dilatation of its cavity. It diminishes the action of the diseased organ; and, along with this, vertigo, pulsation in the head, singing in the ears, and other sympathetic affections of the encephalon attendant upon this condition of the heart, are abated.

In the Common or *Sporadic Cholera* of this country, which seems to depend on an external irritation of the mucous membrane of the whole alimentary canal, in which the liver, by continuity of impression along its ducts, sympathizes, and pours out a large quantity of bile into the bowels, Narcotics are indicated. Van Swieten* lauds them as admirably adapted to allay the nausea and vomiting which usually attend the early stage of the disease. In this affection, the irritation is extended to the spinal marrow, so that the parts supplied with nerves from its motor track, are the seat of severe cramps. There is also great exhaustion, to an extent much beyond that which would result from the mere discharge by the bowels, indicated, as well by the state of the heart's action, as by a morbid impression on the whole ganglionic nerves. In this condition of the habit, the preparations of Opium or the salts of Morphia are the best remedies we can employ. In severe attacks, they should be combined with Calomel; and the dose of the latter should be large, in order to allay, as rapidly as possible, the gastric and intestinal irritation. In slight cases, a grain of Opium or half a grain of Hydrochlorate of Morphia, may be given every second hour: in severer cases, these Narcotics should be combined with Aromatics; the best of which are the volatile oils, in the form of oleosachara; as, in this state, Aromatics produce no chemical change on the salts of Morphia, either contained in, or separate from, the Opium.

The pathology of *Asiatic Cholera* is too little known to enable the practitioner to proceed upon fixed principles in its treatment. In those cases which came under my own eye, I

* Comment. t. iv, § 1296, p. 494.

found the most successful mode of managing it, was, to treat the symptoms as they appeared, without any reference to the name of the disease. In the early stage, my object was to rouse the energy of the habit, if collapse had already appeared, and the stools had assumed a whey-like character: for this purpose, I found a combination of Calomel, Opium, and Cayenne-pepper, well adapted; interposing between each dose a saline draught, containing a moderate quantity, namely, from ʒss to ʒi of Tartrate of Soda and Potassa, with fʒii of the Compound Tincture of Camphor. In the cold stage, I found that Narcotics are of no value; and in that of reaction, or the febrile stage, which comes on when the patient survives the former stages, they are even injurious, on account of the great cerebral excitement which always accompanies it. Under every circumstance, however, the treatment of this disease, it must be confessed, has been hitherto altogether empirical.

In diseases of individual organs, Narcotics are more or less useful.

In *Acute Ophthalmia*, Opium may be internally administered, under the same restrictions as in Pneumonia. It is administered in full doses when the pain and the irritation are excessive, even before venæsection has been resorted to, if it be combined with Calomel and Tartar-emetic. After the acute inflammation of the eye has been subdued, the topical application of the Vinum Opii abates the chronic inflammation which is often long kept up. The Wine of Opium must be dropped into the eye: in rolling over the ball, it excites temporary pain, and sets up a new and a more healthy action in the organ, at the same time that it allays irritation. This practice was first recommended by the late Mr. Ware. The inflammation is often visibly abated by only an application of the wine, although such a speedy effect cannot always be expected. It is peculiarly applicable in those cases where there is much scalding pain, considerable lacrymation, and intolerance of light. On the same principle, Camphor has been topically employed in Ophthalmia; but, it is scarcely requisite to say, that it is suited only for that passive form of the disease which is the result of the scrophulous diathesis, or in old chronic inflammation of the conjunctiva.

In local *Rheumatic affections*, as in general Rheumatism, the narcotic most employed is Colchicum. It is apt to cause hypercatharsis when it is given in large doses; hence the practice of the present day is to administer it in small doses, frequently repeated. When it induces much purging, the bowels will be found to be in an irritable or an inflamed state, in which ulceration of the mucous membrane is likely to follow. Its use should, in such a case, be discontinued, and the compound

powder of Ipecacuanha administered, to check the purging. In my own practice, I have generally combined it with Magnesia and the compound Ipecacuanha powder, from the commencement, and have never observed it to cause hypercatharsis or any deleterious effects.

Opium is now more freely employed than formerly in Rheumatism; and, unless the skin be hot and dry, the tongue parched and brown, and the excitement great, there is no reason why it should not be used to allay pain and to procure rest. Its immediate influence is exerted on the capillaries, whilst the larger vessels are relieved, both by the obstruction caused by the congested capillaries to the circulation in the larger vessels, and, also, by the increased expenditure of blood in the several secretions and excretions which are promoted. The utility of Narcotics in Rheumatism is founded on the following grounds.

1. The inflammation of Rheumatism differs from phlegmonous inflammation, both in its progress, which is often intermittent, and in its termination, which is never in suppuration nor in gangrene.

2. The pain is often great when the pulse is below the natural standard.

3. Experience has demonstrated that, in Rheumatism, either general or topical bleeding is the best prefatory measure to the employment of Opium.

4. When Opium is employed after depletion, it determines to the surface, especially when its action is aided by external warmth and copious dilution; and when the disease is cured, the system is left in a better state than previous to the attack.

The best method of administering Opium in this disease, is, to give the first dose of it after a full bleeding and brisk purgation, and to repeat the dose every third or fourth hour, either alone or in conjunction with Calomel.

In *chronic Rheumatism,* there can be but one opinion respecting the utility of Narcotics: they are excellent adjuncts to the bark or the salts of Quina, or the infusion of Menyanthes *trifoliata,* which is preferable to Cinchona in this form of Rheumatism.

Among the Narcotics, I have witnessed most advantage derived from Conium, gradually carried to a full dose; namely, a scruple of the extract three times a day: and this has been most obvious in chronic Sciatica. When the disease is not wholly removed, the pains are kept under. I have also observed its beneficial influence in that variety of Rheumatism and Paralysis in which deficiency of motion is accompanied with acute pain.

In *Gout,* the idea is now set aside, that pain should not be put down by Opium, and that patience and flannel are the best remedies for the disease. Even in that variety of the disease,

which is called *retrocedent* gout, Opium is our chief resource, and it must be given in full doses. In some cases, ten grains have been given twice a day with advantage; and, unless the dose be too hastily let down, no disadvantage to the constitution results from so large a dose.

In the acute form of *Gout,* Opium has been judiciously combined with Colchicum. Much of the value of Colchicum in Gout is due to its action on the duodenum and the orifices of the gall ducts, emptying the liver: but, although this accounts for its lowering the pulse, yet it does not account for its anodyne influence in allaying pain. Its sedative influence is, undoubtedly, independent of its purgative properties: but this property is always useful as a precursor of its sedative power. When the pulse is full, strong, and quick, the tension of the system should be reduced by blood-letting, and the mucous contents of the intestinal canal evacuated by calomel and an active saline purgative, before Colchicum is employed. This is preferable to combining the Colchicum with purgatives; for when it is so administered, it passes too rapidly through the duodenum to stimulate the gall ducts, and its influence is too transitory in its passage to secure its sedative effect. In a low degree of excitement, Colchicum may be prescribed without previously bleeding or purging; its operation combining the several advantages of bleeding, purging, and narcotics. I am of opinion, however, that the sedative powers of Colchicum are greatly, although not wholly, resident on its purgative properties. The stools are copious, bilious, and frequent; and they seem to arise rather from the stimulant influence of the Colchicia on the orifices of the gall ducts, and the propagation of this action to the liver, than on the stimulant property of the alkaloid on the exhalants of the intestinal canal: at the same time, the analogy of its action on the pituitary membrane of the nostrils, when it is used as an errhine, obliges us to admit that that must be considerable. In general, in my opinion, Colchicum is not administered early enough in this disease; for, in the first stage, it both operates more favourably, and the constitution suffers less. When symptoms authorize its administration, Colchicum may be given either in a large dose to purge freely, or in small, frequently repeated doses. From fʒss to fʒi of the wine of the seeds may be given at bed time, and repeated once in eight or ten hours, till it purge briskly: after which, it may be continued in doses of m. x or m. xv, once in three or four hours. If much acid be present in the stomach, Magnesia should be conbined with it, otherwise the Colchicum passes too rapidly through the duodenum, and does not affect the liver in that manner which is requisite to obtain its sedative effects. It has been contended that these sedative effects are more certainly perceived when no purging takes place; but I have never observed this to be the

case. As a proof that its sedative influence is distinct, it has been stated that one object in view, in prescribing it in gout and rheumatism, is to check its disposition to purge, in order to secure its sedative influence. The explanation I have already given of its influence on the gall ducts being increased, when its passage through the duodenum is impeded, readily explains this effect. This opinion does not set aside the necessity of bleeding and purging before prescribing Colchicum in gout. In this disease, the excitement is not confined to the pained organ, but is generally diffused; hence the nervous system becomes more susceptible of impression, and the mucous membrane is brought into that condition which might induce hypercatharsis from a full dose of Colchicum. It has been contended that Colchicum, administered for the relief of gout, renders the habit more susceptible of a return of the disease*; but such an opinion is not in accordance with my experience.

It was the custom of Sydenham to prescribe laudanum in distinct *Small-pox;* a practice into which we are not to be indiscriminately led by the weight of such high authority. In distinct Small-pox, the eruptive fever is of the inflammatory type, and requires depleting measures: but, unless convulsions supervene, Narcotics are not indicated. During the period of maturation, however, when restlessness from the irritation of the skin is distressing to the patient, an Opiate may be administered at bed time. In confluent Small-pox, however, the plan of Sydenham, who regarded opium as much a specific in this form of the disease, as Cinchona bark in ague†, may be safely followed. To an adult he gave a full dose of liquid laudanum every night, until the eruption was completed; after which, he administered the Syrupus Meconii, a preparation resembling Syrup of Poppies, night and morning daily, for some days. This practice of this great physician is not to be blindly followed in every case of confluent small-pox. Opium, however, may be required when the eruption is preceded by convulsions resembling those of epilepsy, which exhaust the strength, and therefore ought to be checked as soon as possible; and, under such circumstances, the dose of opium, in whatever form it is prescribed, should be large and frequently repeated. In the wild delirium also, which occasionally accompanies the confluent form of the disease, and which, in adults, is attended with a strong disposition to suicide, a full dose of Acetate of Morphia, repeated at intervals of five or six hours, tends greatly to calm this perturbation of the brain and nervous system. Henbane, in such cases, is often more useful than the Salts of Morphia. I have ordered it in doses of eight or ten grains of the Extract, in combination with ten

* Scudamore, Treatise on Gout and Rheumatism, 3rd edit. p. 197.
† Opera Universa. p. 371.

grains of Camphor, administered at bed-time, with the best results. In cases accompanied with spasm or convulsions, it may be combined with Ipecacuanha or an antimonial; or, if much languor be present, with Serpentaria. When the fever assumes the typhoid type, when the pulse is quick and small, the breathing embarrassed, the voice hoarse, and, at the same time, tremors of the limbs and colliquative diarrhœa are present, Opium in small doses, in conjunction with wine and the salts of Quina, is indicated, and always proves serviceable.

Sydenham regarded diarrhœa necessary in Small-pox, especially in the decline, to carry off what he regarded the dregs of the disease; but, notwithstanding his authority, the diarrhœa should be checked, and nothing answers this intention so effectually as Opium, in combination with Ipecacuanha.

In measles, as in small-pox, the inflammatory nature of the fever contraindicates the employment of Narcotics in the early stage of the disease; more especially Camphor, which has often been prescribed from the erroneous idea that its primary action is sedative; but when the inflammatory stage is subdued and cough remains, the Narcotics, in combination with Calomel and Ipecacuanha, or Tartar-emetic, are indicated. If diarrhœa, which often proves useful at the close of the disease, is severe, opiates may be advantageously employed to check it; and when the debility is great, the administration of tonics and cordials does not interfere with that of opiates. On the contrary, in the malignant form of the disease, there cannot be a better adjunct to wine and other cordials than Opium.

From the physiological influence of Belladonna to produce an eruption on the skin resembling Scarlatina, Hahneman proposed it as a prophylactic against the contagion of that disease. His directions are to dissolve gr. iii of the Extract in f℥i of Cinnamon water, and to administer m. iii of the solution twice a day to a child a year old, adding one drop for every year until twelve be taken for a dose; and this continued whilst the infection rages. This practice, absurd as it appears, gained supporters in Hufeland and others; but it is deservedly neglected.

In *tubercular Phthisis*, it is scarcely necessary to say that narcotics are indicated for particular symptoms; namely, cough and diarrhœa. For palliating the cough, no medicines can compete with some of the preparations of Opium; and for this purpose it was much lauded by Dr. Reid*; but it should be sparingly employed in the early stage of the disease, in which the cough is more likely to be abated by emetics, to unload the bronchi and improve the secretions, than by Narcotics. In the advanced stage of the disease, when the tubercles have softened and ulcerated, nothing relieves the evening paroxysm of cough-

* Essay on the Nature and Cure of Phthisis Pulmonalis.

ing and the hectic fever so much as a full dose of a narcotic, administered so as to anticipate the accession of the paroxysm. Opium, however, and the Acetate of Morphia have one disadvantage at this period of the disease—they increase the tendency to perspiration, which is already too great. On this account, and to leave the stomach unaffected, I prefer the endermic method of administering opium, to its administration by the mouth. One grain and a half of Hydrochlorate or Acetate of Morphia, sprinkled upon a blistered surface night and morning daily, rarely fails to afford much comfort to the patient. Besides acting as a narcotic, its salutary influence is extended by its causing an eczematous eruption, and operating as a counter-irritant.

When the dyspnœa is severe in the last stage of Phthisis, Narcotics are also indicated. Some practitioners recommend a combination of Ether and Opium; Laennec extols Belladonna, and Sir James Clark affirms that he has found Extract of Stramonium, in doses of one-fourth or half a grain daily, afford the greatest relief. If diarrhœa occur, nothing proves so beneficial as Opium in the starch enema.

Galen prescribed Camphor in hectic; and Poterius, who was a disciple of Paracelsus, employed it in the form of vapour, in conjunction with Assafœtida, in Phthisis; Lieutaud, Burserius, and Dr. Percival, were also its advocates; and Dr. Rolls recommends it, combined with hepatized Ammonia and Conium, in the incipient stage of the disease. Digitalis has been prescribed in Phthisis, not on account of its operation as a narcotic, but as a sedative. It is, however, fitted only for the advanced stages of the disease, when all chance of inflammation supervening is at an end. Conium and Henbane, on the contrary, may be administered at any period of the disease.

The propriety of administering Narcotics in *Dysentery* is still a matter of dispute. But when means have been adopted to allay the inflammatory symptoms, and, nevertheless, pains and tenesmus continue, the advantages derived from opium, administered both by the mouth and in the form of enema, are too obvious to be overlooked. The bowels should be freely evacuated once at least in twenty-four hours, and opiate enemas, in small quantity, so as not to operate by bulk, should be administered in the intervals. When the tenesmus is very urgent, the opium should be combined with Ipecacuanha, in doses of gr. xii to gr. xvi, and both conjoined with gr. x to ℈i of Extract of Gentian, whether it be employed in the form of enema or given by the mouth. In this combination, the Extract of Gentian prevents the Ipecacuanha from nauseating, without in the smallest degree diminishing its influence in allaying the tenesmus. Dr. Cheyne followed blood-letting with large doses of Opium in combination with Calomel. He remarks—“it was the Opium

chiefly that seemed to arrest the progress of the inflammation: and whatever, in such a case, procured respite to the patient from agony, sometimes proved of permanent benefit*." I have usually prescribed the officinal Tincture of Opium, with Castor oil. The solution of the Bimeconate of Morphia is well adapted for such a combination.

In *hydrophobia,* Narcotics have failed of producing any beneficial effects. Opium has been administered in quantities almost as large as those prescribed in tetanus: Dr. Vaughan gave 57 grains in fourteen hours, and Dr. Babington 180 grains in sixteen hours, without any benefit, and without even procuring sleep†. Majendie injected the solution of opium into the veins of rabid animals without producing any narcotic effect. Dupuytren injected gr. viii of the Extract of Opium in solution into the crural vein of a young man labouring under a severe attack of the disease, with temporary benefit; but he died on the fifth day from the commencement of the attack. Dr. Brandreth injected the solution of Acetate of Morphia, in quantity equal to gr. iv of opium, into the veins of a young man in the height of the disease, with a decisive temporary mitigation of his sufferings; but this injection has since been tried, and has totally failed. Opiate frictions have also procured some abatement of symptoms; and, on the whole, Opium, although it has failed, yet it has this advantage, that it has rendered the sufferings of the patients less severe than they would otherwise have been. Belladonna, at one time, was much confided in, as a Narcotic, in this disease, owing to the success which attended its administration by Biera and Massalien; but it has not maintained its reputation. Stramonium and Conium have equally failed of producing any permanent advantage.

Among the painful local affections in which Narcotics are indicated, *Scirrhus* is one of the most urgent. The pain is most acute and lancinating; and it is probable that it arises from the compression of the nerves within the dense, scirrhous masses, as well as from irritation, when these begin to soften and to ulcerate. In this stage of the disease, the pain is most acute when scirrhus affects internal organs. Under such circumstances, much cannot be expected from Narcotics that simply operate as anodynes: it is those that act on the local affection, as well as the general system, which are to be preferred. How they operate, I shall not venture to explain; but experience has displayed the powerful influence of some of them, especially Conium and its preparations, when applied on the scirrhous part. This Narcotic has, in my opinion, been very unfairly tried, except by Störck, by Recamier, and in a few cases by myself. The dose has either been too large at first, or it has not

* Dublin Hospital Reports, vol. iii. † Medical Records and Researches.

been gradually carried to a sufficient extent; and, during its employment, a strict adherence to a milk diet has not been attended to for a sufficient length of time. In one case which came under my care, and which has completely recovered, the dose of Extract of Conium was ultimately carried to the extent of ʒi three times a day; and, after the cure seemed confirmed, the dose was as gradually let down as it had been raised. It is true that, in this case, Iodide of Iron was also administered; but I have not seen the advantages result from its use alone, as when it was combined with Conium, carried to the utmost dose. Aconitum has been employed in the same manner as Conium in Scirrhus; but assuredly not with the same success. Lambergen, Cullen, De Haen, Juncker, and others, relied much on Belladonna in the early stage of the disease; but anodyne effects only were obtained from its employment.

In *carcinoma of the uterus*, the agonizing sufferings of the patient can only be moderated by Narcotics. Opium or Conium may be indifferently employed; but, as the anodyne effect is required to be suddenly produced, Opium is generally selected. It is best employed in the form of suppository, or in that of enema, combined with mucilage of starch, or warm milk, whilst, at the same time, a plaster of the Extract of Belladonna is laid over the sacrum. I have observed more advantage derived from blistering the sacrum, and sprinkling the blistered surface with the Hydrochlorate of Morphia, than from the Belladonna plaster. When hæmorrhage occurs, the Opium suppository must be discontinued, and injections of the Solution of Iodide of Iron, largely diluted, substituted for it.

In *scrofulous affections*, as in all diseases attended with pain, Narcotics are useful. Opium, Henbane, Belladonna, and Conium, have been indiscriminately employed. I confess that I have always been in the habit of preferring Conium; but, at the same time, I must also admit that this preference has not arisen from having observed any superior advantages in Conium over other narcotics in this disease. In one form, however, of Scrofula, namely, Tabes mesenterica, it certainly operates more beneficially than Opium.

In *Syphilis*, Narcotics have always proved useful; and, at one time, Opium was regarded as a powerful antisyphilitic: indeed, Dr. Michaelis, the physician of the Hessian troops in the service of Great Britain, during the American war in 1779, regarded it almost as a specific. It is curious to compare the results of his practice with those of the opposers of the employment of mercurials in our time. He found that, when Opium was used alone, the proportion of cases cured, to those not cured, was as three to one; and that Opium succeeded when Mercury failed. He generally commenced by giving three grains in twenty-four hours, in divided doses, gradually increasing the

quantity to half a drachm; at which point, the Narcotic often operated as a diuretic and caused ptyalism. What is remarkable, it often induced severe diarrhœa. When it was accompanied with tremors and great depressions, it was necessarily abandoned. In the perusal of the details of Dr. Michaelis's practice*, one thing is evident—namely, that much benefit may be obtained from taking advantage of the sedative property of Narcotics, either in combination with mercurials, or alone, to allay that highly irritable condition of the system which often remains after the virus of syphilis has been subdued. Saunders, Cullen, and many others, put the practice of Michaelis to the test of experiment, in the hospitals of London, and in the Royal Infirmary of Edinburgh; but their reports were not of a nature to afford more than a slender and fluctuating confidence in Opium as an antisyphilitic. The most decisive experiments were made by Mr. John Pearson at the Lock Hospital: the results were unfavourable, and the specific virtues of Opium in Lues Venerea are now merely a matter of history. Like every other Narcotic, Opium, by allaying the general irritability, enables the system to bear the action of mercurials better than it would otherwise do; but "it communicates," says Mr. Pearson, "no additional virtues to Mercury,—it assists the constitution of the patient, not the operation of the medicine with which it is combined†." Mr. Pearson sums up his opinions by this judicious and correct remark—"a confidence in the antivenereal virtues of opium would be a source of greater mischief than its most valuable properties would be able to compensate‡." Nearly the same opinion may be advanced with respect to Conium, which was regarded by Störck§ and Dr. Collins|| as, if not a specific, one of the best aids to the influence of mercurials that can be employed. It is useful in spreading irritable ulcers, occurring either during the active period of the disease, or after the completion of a mercurial course; and "it would seem," says Mr. Pearson, "that the benefit conferred by this drug ought not to be ascribed solely to its anodyne qualities; since the same advantages cannot always be obtained from the liberal exhibition of opium, even when it does not disagree with the stomach¶." Upon the whole, we may conclude that, however useful Narcotics may prove in syphilis, they cannot eradicate the virus without the aid of mercury.

With regard to that division of imponderable Narcotics which

* Medical Communications, vol. i, p. 307.

† Observ. on the Effects of various Articles of the Mat. Med. in Lues Venerea, 8vo, 1800, p. 59

‡ Ibid, p. 61.

§ Opera, lib. ii, de Cicuta.

|| De Cicuta Efficacia. Cor. iv, p. 153.

¶ l. c. p. 94.

operate indirectly upon the habit, the first is Music. As a therapeutical agent, this can only be employed in one description of diseases, namely, those classed under the general term *Insanity;* but it is not adapted for every variety of Insanity. In order to understand this exception, let us inquire into its mode of acting as a Narcotic. Music, at first, whatever may be its character, operates as an excitant: it rouses the attention; and it is a well-known fact, that only one object can occupy that faculty at the same time; hence the sensation of pain is lost in the new direction given to the mind. If the music which is chosen be that in which the individual delights, the attention is chained to it; but, nevertheless, by its continuance, like the continued action of any substantial narcotic, its excitant influence is followed by exhaustion, and sleep is induced. The impression must be such as will produce a stronger impulse on the mind than that which previously engaged it. The withdrawing of the attention is, in fact, a voluntary act; the impression on the corporeal organ, namely, the auditory nerve, excites the hearer to the act of volition; but, in thus changing the object of his attention, the person only yields to a stronger impression than that which previously acted on his mind. In this respect, therefore, the impression on the corporeal organ is the primary excitant of the act of volition; but the effect on the diseased part, or rather the relief which follows this act of volition, is purely mental. The relief is truly in the ratio of the intensity with which the new impression is capable of employing the attention; consequently, music can act as a narcotic only on those who are naturally delighted by it. Without this feeling of pleasure, the effect of music would fail; the attention would not be sufficiently aroused; it is this act of volition, this power of exposing, as it were, the sensorium to a particular impression, that gives the intensity and distinctness to sensation; and a secondary result increases the tendency to the state of collapse, which induces sleep.

But, admitting that the bias given to the attention is sufficiently strong to withdraw it from the seat of pain; it is still a necessary ingredient for producing a narcotic effect, by influencing the mind, that the same impression should be repeated for a sufficient length of time to cause exhaustion. If music be the agent, it is not the mere succession of sounds which causes this effect, but the repetition of the *same* combinations of sounds or impressions.

In some peculiar cases of insanity, Music may be employed as a soporific; and the evening is the best time for trying its effects. One reason for selecting this period of the day, is, that when sleep is induced, there is much less likelihood of its being disturbed, than if it occurred during the day. It was employed by Esquirol—who says, it calms the patient, but it does not cure. In Melancholia, its utility is greater than in Mania; but the

instruments, says Esquirol, should be few, and the airs chosen should be adapted to the condition of the patient. The most extended experiments with it were made at Charenton; the results were, that it is chiefly in convalescence that Music proves useful in Insanity—" Ce moyen est precieux particulierement dans la convalescence, il ne doit pas être négligé*"—are the words of Esquirol.

This distinguished physician mentions some remarkable results of the influence of Music on an idiot of the name of Quenau, in the Salpetriere. " She seemed enrapt by it, yet she was utterly inattentive to every thing else." Esquirol adds, " the organ of music, according to phrenologists, was not at all developed." In this application of Music as a Narcotic, the chief difficulty arises in determining the character and taste of the individual, so as to adapt the music best fitted for the occasion and the nature of the disease. In some instances, the music should be such as to withdraw the mind of the patient from old associations, and to direct his attention into a new channel of ideas: in other cases, instead of doing so, it will be most salutary to recall his mind to former habits, and to spread before his imagination the scene of past hours, in which domestic happiness reigned undisturbed in the bosom of the sufferer. Under such circumstances, one great step in the moral treatment of insanity is attained, namely, diverting the attention and fixing it on new objects; by a continuance of which, the cloud which settled upon the mind may be happily dispersed, and Reason restored to her seat.

The application of gentle and slow friction in producing a narcotic result, is well known: its effects may be referred to the repetition of an agreeable impression on the nervous system. I have seen it produce sleep in many instances. In painful affections, in particular, gentle friction produces a soothing effect, by transferring the attention from the seat of pain to the mild and agreeable impression of the friction.

It is rather amusing to reflect, that this species of imponderable therapeutical agents admits of combination. Sound, although it operates as a Narcotic, operates with less energy alone, than when it is combined with friction. I recollect an instance of an old lady exulting over a physician who had failed to relieve severe pain of a neuralgic kind, by affording decided ease by friction and a dull crone or hum continued for an hour. The fact is further illustrated by the common mode which nurses take to lull infants to sleep, by moving the hand gently over the back, and at the same time humming a monotonous tune. Were it proper to occupy the reader's time longer with this subject, I could mention many cases of the beneficial

* De Maladies Mentales, tome i. p. 137.

influence of friction thus employed operating as a Narcotic. In every instance the movement must be unvaried.

Under the head of gentle Friction, another mechanical Narcotic may be placed, namely, *the circular Swing*, which was introduced by Dr. Cox*, and has been frequently employed with advantage in certain cases of Mania. This swing was not originally intended to produce a narcotic effect; but, when the rotation is slow and long-continued, it has been found "to induce the most perfect repose†, accompanied by a gentle diaphoresis." To effect this desirable end, the patient is placed in the swing, in an horizontal position, and the rotations continued for some time, slowly but steadily. It rapidly lowers the circulation and the temperature of the body; and subdues, in a remarkable degree, the violence of the most furious maniacs. It must, however, be always kept in remembrance, that in young, plethoric individuals, where there is an apoplectic tendency, it is a hazardous expedient: and in such cases it ought never to be employed.

SECTION VII.

ANTISPASMODIC.

Antispasmodics may be defined—medicinal substances which resolve irregular and inordinate muscular contractions.

In order to comprehend aright this definition, we must have some idea of the nature of muscles and their functions. It is not requisite, however, to enter into any examination of their *minute* structure, in the present instance; it is sufficient to state, generally, that they are bundles of fibres, which consist of parcels or fasciculi of smaller fibrillæ, enveloped in cellular tissue, and supplied with *blood-vessels*, *lymphatics*, and *nerves*. These are the common characters of all muscles, whether internal, membraniform and hollow, contracting involuntarily and subservient to the functions of nutrition and generation: or external, belonging to the skeleton, to the organs of sense, the skin and the larynx, contracting on the power of the will and subservient to the animal functions.

The nerves of muscles are large, and proportionate in number and size to the volume of the muscles. They penetrate into the muscles, ramify in them, and probably extend to the primary fibrils: but no instruments which we possess have enabled us to ascertain how this is accomplished.

During life, muscles possess sensibility; but this property

* For a description of the Swing, see Cox on Insanity, 3rd edit. p. 27.
† Hallaran's Practical Observations, 2nd edit. p. 92.

is due to the sensitive nerves distributed to them, not to the muscular fibres themselves: they are, also, endowed with a susceptibility of action, which has been named irritability: and which, when acted upon, in some cases by *volition*, in others, by *chemical*, *mechanical*, or *electrical* stimulants, produce muscular action or contraction. Haller regarded this property to be inherent in muscles, independent of their nerves; a theory which modern physiology has attempted to overthrow; but which has still supporters. The conditions of this irritability are the vitality of the muscle, and its connection or communication with the nervous and circulating centres, and its integrity: that is, in order to act, the muscles must communicate, by means of the nerves, with the nervous centres: they must participate in the circulation; they must be entire; and experience has demonstrated, that their action is impeded or opposed by contusion, inflammation, the accumulation of fat in the interstices of the bundles of fibrillæ, and similar circumstances. Whatever may be the impulse given to a muscle; when it acts, it contracts or shortens its length between the extremities, and becomes thicker. The ultimate cause of this, is supposed, by Prevost and Dumas, to be an electrical phenomenon. They suppose that the nerves, supplying muscles, are attached to the fibres at right angles, and thus enter them at definite intervals, forming, as it were, a galvanic pile: and, when these nerves are excited, they approach one another so as to draw the fibres into angles, and thus shorten them, or cause contraction. But, ingenious as this explanation is, how very inadequate is it to account for the effect produced. The rationale of the muscular action is incompatible with, and far beyond, the highest powers in physics: it leaves at an immeasurable distance those of chemistry: it is, in fact, a *vital* phenomenon, of the cause of which we know nothing.

Volition acts upon muscles through the medium of the nerves; but some muscles do not respond to the will: all, however, are affected by emotions of the mind, through the same means; all are called into action by irritation of certain parts of the encephalon, the spinal-marrow, and the nerves: they also act, on the application of a stimulus to some determinate part of the skin or mucous membrane, or the membrane directly covering them; as, for example, the lining membrane of the heart; the cellular sheaths of the muscular bundles of fibres, and the serous membrane of the abdomen. The irritation of one part of a muscle produces contraction of a whole muscle, sometimes of many muscles.

All the muscles subservient to the will, receive their nerves directly from the motor tract of the cerebro-spinal centres: the will acts only on that part of the system; but the influence is conveyed by the nervous fibres, just as an elastic cord vibrates

in its whole length, when struck at any one point*. The excitation of certain fibres by the will, causes, constantly, the same motions, the same changes of position, and the same consequent sensations, when the body is in a state of health. Hence, even compound voluntary movements are regular, consentaneous, and harmonizing. Involuntary actions are produced by stimulants acting on the membrane covering muscles, as in the alimentary canal, the urinary bladder, the heart; and the muscles associated in the processes of deglutition, of respiration, of coughing; the fæcal and urinary excretion; parturition, and the emission of the spermatic fluid. Accidental irritations of the nervous centres; the nerves, or the muscles themselves, render the contraction of *voluntary* muscles *involuntary*; or, in other words, cause *spasms* or *convulsions*, or other inordinate action. This is even displayed after death; for muscles can be thrown into action by stimulating a nerve leading to them, by the galvanic influence; and the heart contracts, when acted upon by mechanical and chemical stimuli, for a short time after death. The irritability of involuntary muscles appears to be less dependent on the nervous influence than that of the voluntary muscles; hence, mechanical and chemical irritations are *more* effectual in determining contractions in them. Sympathy determines action in muscles distant from those thus acted upon: as, for example, the titillation of the gullet, determining the action of the stomach, and of the respiratory and abdominal muscles, causes vomiting; that of a suppository, the peristaltic movement of the intestinal canal. Such aro the normal or ordinary action of muscles: let us now enquire, what are the causes of the inordinate or irregular actions, and the nature of these, so as to understand the definition which distinguishes the class of Therapeutical agents which we are now about to examine.

The contraction of the external muscles, through causes which act upon the muscular tissue, or upon the nerves, or upon the cerebro-spinal centres, may become permanent, as in tetanic contraction; or involuntary and irregular, as in convulsions, clonic spasm or contraction. It is this description of muscular action which antispasmodic medicines are intended to resolve. It differs from the normal action of both voluntary and involuntary muscles, which is an alternation of motion and quietude, whether the exciting cause be mental or material. The effect takes place; but the motion is more or less transitory, and always followed by a state of rest; the action, also, in every case, ceasing when the exciting cause ceases to operate. In spasm, the contraction continues after the operation of the exciting cause ceases; or, if a succession of irregular actions have followed the impression of an irritant, these, continuing, constitute convulsions. These effects are frequently the result of

* Muller.

irritations, communicated either to the origins of the motor nerves, or to their sentient extremities. In some instances, it is the result of too great susceptibility of impression, owing to a want of that condition of healthy tension in muscles which is denominated tone.

All substances that diminish the susceptibility to impression in muscles, and which allay irritation, or render muscles less prone to spasmodic or convulsive action, and tend to resolve it when present, are Antispasmodics. A question here arises—in what respect do *Antispasmodics* differ from *Narcotics*, which we know are capable of producing these effects? The chief circumstance which characterizes Antispasmodics, as far as regards their effects on muscles, is the *absence* of a certain degree of collapse, and of the partial diminution of sensibility to impressions which almost invariably follow the administration of *Narcotics*. No such effects are induced by *Antispasmodics*, even administered in large doses; yet many of them are more powerful than Narcotics in repressing inordinate muscular motion.

The manner in which they operate to repress morbid action in the affected muscles is not understood; but there is every reason for thinking that their influence is exerted on the nerves, and, through them, on the muscular fibres. The premises for this conclusion are derived from observations as correct as those which have determined that the contraction of a muscle is attributable to the nervous system. But although we have no correct idea of the manner in which Antispasmodics impress the nerves in resolving spasm, yet we may hazard an opinion respecting the manner in which this is effected by them, and by Narcotics; and whether the action of Antispasmodics is to be regarded as stimulant or sedative.

The hypothesis which I venture to offer, in explanation of the distinction between a Narcotic and an Antispasmodic, is founded on the fact of a distinction existing between the nerves of sensation and those of motion. I conceive that the impression of a Narcotic is confined to the *nerves of sensation*, and must be communicated to the brain before its influence on any organ, in a diseased state of excitement or sensation, is experienced; whereas, the action of an Antispasmodic is confined to the *nerves of motion*, and produces an immediate change of action in these nerves, independent of any communication with the sensorium commune, or the cerebro-spinal centres. Their operation, in this respect, resembles that of Sedatives: it is immediate on the nervous extremities of the tissues with which they come into contact. They hold an intermediate space between Narcotics and Tonics. The former allay *susceptibility to impression, and depress sensibility*; therefore they render muscles less likely to take on spasmodic or convulsive action, and resolve and abate those especially which are the

result of irritants operating on the sensibility of parts: the latter afford to muscles a tolerance of irritation, so that it is not followed by inordinate action. Antispasmodics *resolve* and *abate* spasm and convulsions; but they do not place the muscles in a condition to resist the renewed influence of the irritating agent; they are less diffusible, but more permanent, in their effects than Narcotics; *more immediate*, but *less permanent*, in their results than Tonics, a class of medicinal agents which we have yet to examine.

With respect to the question, whether Antispasmodics are sedative or stimulant agents? If any hypothesis be correct, it might be supposed that the necessary conclusion would be in favour of their possessing a *sedative* influence: for, if the inordinate or irregular action which they overcome be the consequence of irritation, it implies an exaltation of the nervous energy; hence it follows, that the substance which resolves spasm, or calms convulsions, must necessarily lower this exaltation, and therefore operate as a Sedative. It does not follow, however, that this sedative effect is always immediate; it may be, in some instances, *consecutive* of a previous stimulant operation; and this is most probably the case, as many Antispasmodics, when administered in the absence of spasm or convulsions, operate as general excitants, quickening and augmenting the force of the pulse, and rousing, generally, the powers of the habit. It is, nevertheless, true, that some agents operate as *direct Sedatives* in resolving spasm, and really belong to that class of medicines; as, for example, Hydrocyanic Acid and Carburetted Hydrogen gas: Fear, also, has been supposed to operate as a Sedative; but its action more resembles that of a Narcotic, being partly excitant, partly sedative.

From the view which we have taken of the means exerted by various substances in resolving spasm, we might arrange, in this class, *Sedatives*, *Narcotics*, and *Tonics*, besides those substances that are more particularly regarded as Antispasmodics. With respect to the action of the latter, their effects are generally perceptible very soon after their administration: more especially if the muscular energy of the individual be in a depressed state. Much, however, in reference to the rapidity or energy of their action, depends on the cause of the spasm, whether it follow exhaustion or collapse; or whether it is co-existent with, and in some degree dependent on, a state of excitement, and excessive momentum of the circulation in the vessels of the brain or spinal marrow. The first may depend on circumstances that depress the nervous energy more than the system can support: as, for example, when blood-letting is carried to syncope, convulsions frequently follow, owing to the defect of that amount of stimulus which the blood affords to the brain, and which is essential to the exercise of its healthy function.

Why the same result should follow *defective* and *excessive* stimulus to the nervous centres, cannot be easily explained; but every day experience demonstrates the fact. The second state, that of excessive momentum in the cerebral vessels causing convulsions, has been illustrated in many instances in which these inordinate actions have immediately ceased on impeding or diminishing the flow of blood through the carotids to the brain: in various disorders, also, in which convulsions supervene, there is evidence of excessive cerebral irritation. In the former condition of the nervous centres, Antispasmodics are indicated, and operate advantageously; in the latter, they may prove injurious.

In prescribing Antispasmodics, it is requisite to direct our attention, therefore, to the condition of the habit in which spasm or convulsions appear. If it be in a state of excitement, and if spasm is the result of inflammation in the cerebro-spinal centres, or their meninges, or of a congested state of the cerebral vessels, then Antispasmodics ought not to be administered until blood-letting and other depleting measures, calculated to subdue this condition of the system, be resorted to. If no excitement be present, but the tone of the habit is rather low, then they may be administered at once, with a well-founded hope of advantage. In employing Antispasmodics, also, it should be recollected that their influence is transitory, and, by frequent repetition, is much weakened; so that the dose requires to be modified, according as the patient *has* or *has not* been accustomed to their influence.

Antispasmodics may be arranged into two classes—1. *Direct* —comprehending those substances which resolve spasm by acting through the nervous system; but neither as Sedatives, nor Narcotics, nor Tonics. 2. *Indirect*—comprehending those substances which, being Sedatives, Narcotics, and Tonics, resolve spasm and allay convulsions.

TABLE OF ANTISPASMODICS.

A. DIRECT ANTISPASMODICS.

PONDERABLE AGENTS.

Animal Products.

a.—Musk—a secretion of the Moschus *moschiferus*. 1. 7. Ruminantia.

b.—CASTOR—a secretion of the Castor *Fiber*.	1.	4.	Rodentia.
c.—EMPYREUMATIC OIL OF DIPPEL.			

** *Vegetable Products.*

d.—ASSAFŒTIDA—from the root of Ferula *Assafœtida*.	5.	2.	Umbelliferæ.
* ——— *Persica*.	–.	–.	———
e.—SAGAPENUM—from the stem of Ferula *communis ?*	–.	–.	———
f.—GALBANUM—from the stem of Galbanum *officinalis*.	–.	–.	———
g.—OPOPONAX—from the stem of Opoponax *Chironium*.	–.	–.	———
h.—VOLATILE OIL—in the roots of Valeriana *officinalis*.	3.	1.	Valerianaceæ.
* ——— *Dioscorides*.	–.	–.	———
i.—OLEO-RESIN—in the roots of			
* Peucedanum *montanum*.	5.	2.	Umbelliferæ.
* Symplocarpus *fœtidus*.	20.	5.	Araceæ.
k.—BITTER EXTRACTIVE—in Artemesia *absinthium*.	23.	1.	Leguminosæ.

*** *Mineral Substances.*

l.—ACIDUM HYDROCYANICUM.
m.—ÆTHER SULPHURICUS.
n.—SUCCINI OLEUM.
o.—NAPHTHA.
p.—PETROLEUM BARBADENSE.
q.—AMMONIÆ SESQUICARBONAS.
r.—ZINCI OXIDUM.
s.—CUPRI AMMONIO-SULPHAS.

B. INDIRECT ANTISPASMODICS.

* PONDERABLE AGENTS.

TONICS and NARCOTICS.

* * IMPONDERABLE.

MENTAL INFLUENCES.

ORGANIC ANIMAL AND VEGETABLE PRODUCTS WHICH OPERATE AS DIRECT ANTISPASMODICS.

a. MUSK, *Moschus,* L. E. D.—This is the secretion of an animal having a near affinity to the deer tribe, the Moschus *moschiferus*, a native of Thibet, China, and Siberia; belonging to the order Ruminantia of Cuvier*. The animal is small, resembling the deer; but it is devoid of horns, and the upper jaw in the male is furnished with two canine teeth, that project over the lower lip and resemble tusks (p. *63). The Musk is contained in a bag, which lies close to the skin at the posterior part of the abdomen of the animal. It is situated under the skin, and opens, exteriorly, by a small aperture immediately in front of the præputial orifice. It is an appendage only of the male. The bag is of an oval form, flat on one surface, convex on the other. On the convex side, it is covered with stiff hairs; but on the flat surface, which is applied to the abdomen of the animal, it is a naked membrane. The bag is lined with an irregularly plaited membrane, in depressions of which are the glands that secrete the Musk, which, during the life of the animal, is soft, unctuous, in irregular, reddish-brown granules. The quantity in the bag varies; but ʒii may be regarded as the average†. It is always full of Musk in the adult, and empty in the young deer; the quantity is greater, and the quality of the Musk better, if the animal be taken during the rutting reason. The skin which covers the musk-bag has few vessels; but the cellular matter contains a great many; and the bag, internally, presents small, unequal valves. The Musk Deer is a timid animal: it rarely appears during the day; consequently, the Musk collectors watch and surprise it at night. It is sometimes taken in pit-falls.

Two kinds of Musk are found in the market. One, the Tonquin or Chinese, has the bag covered with reddish or cinnamon-coloured hairs: the other, called Kabardine or Russian, is covered with coarse white hair. The Tonquin is the best: it should always be bought in the bag, or *pod* as it is termed. The Kabardine is inferior to it in every respect. The Musk is in concreted, brown, granular masses, slightly unctuous, and free from grittiness when rubbed between the fingers. It is bitter and somewhat acrid to the taste; its odour is powerful and astonishingly durable. In many individuals, the odour of Musk causes headache; and, in some instances, when it is strong, convulsions. Musk burns readily, and leaves a light, spongy charcoal. Boiling water takes up about eighty parts in one hundred of Musk; the infusion affords precipitates with sulphate of iron, acetate of lead, nitrate of silver, and infusions of astringent vege-

* Règne Animale, t. i, p. 251. London Dispensatory, 6th edit. p. 444.
† Pereira's Mat. Med. p. 1396.

tables. Alcohol dissolves fifty parts in one hundred; and forms a tincture of a reddish-brown colour, exhaling scarcely any odour of the Musk, unless water be added to it, which instantly develops the odour. Ether takes up nearly the whole of the Musk.

According to the analysis of Blondeau and Guibourt, and that of Geiger and Reinmann, Musk consists of *stearine, elaine, cholesterine;* an *acid oil* combined with ammonia, *free ammonia; muriates of ammonia, potassa,* and *lime;* an undetermined *acid,* combined with *ammonia, potassa,* and *lime; gelatin, albumen, fibrin, carbonized matter,* soluble in water; *carbonate* and *phosphate of lime, water**, and a peculiar *bitter resin;* which can be readily separated by ether, from which it is deposited on the surface of the water.

The high price of Musk is a strong inducement for its adulteration, and this is not confined to the grain musk. The spurious Musk bags are usually larger than the genuine; but they are deficient of the aperture which exists in the centre of the hair-covered side of the true bag. Spurious grain-musk is formed by rubbing together dried bullock's, a small quantity of ammonia, and some genuine Musk.

Musk, in moderate doses, operates on the nerves of the stomach; causing, when this organ is in an irritable state, nausea, and a sensation of heat at the epigastrium. If the dose be repeated at short intervals, it acts as a general excitant and antispasmodic, increasing the force and quickness of the circulation, and exciting perspiration. It is taken into the blood, and the odour of the drug becomes evident in the urine, the sweat, and other excretions: and, in post-mortem dissections of persons under a course of Musk, every cavity and tissue is found to be penetrated by it. From the report of M. Jorg and a society of experimentalists at Leipzig, the primary influence of Musk appears to be that of an excitant on the stomach, causing increase of appetite, dryness of the gullet, and eructations; the secondary, on the nervous centres, causing vertigo, headache, nausea, drowsiness, and a general sensation of heaviness, and faintness†.

Musk is more employed on the Continent than in Britain, which is partly attributable to the high price of the drug. It has been found useful in hiccough, palpitation of the heart, and in spasms of the stomach and intestines, depending on some sympathetic irritation of the spinal and ganglionic nerves, when administered in doses of a scruple, repeated every four hours‡; and, at the same time, it acts as a cordial and diaphoretic.

Musk is administered in the form of Mixture and Tincture.

Mixture of Musk, *Mistura Moschi,* L. contains three

* Guibourt's Hist. de Drogues Simples.

† Material. zu einer Argneimit. Leip. 1825. ‡ Clark on Diseases of Long Voyages.

drachms of Musk in the pint; it is kept suspended by Acacia gum and sugar. The dose is f℥i to f℥ii.

Tincture of Musk, *Tinctura Moschi*, D. is a spirituous solution of the soluble matter of Musk, containing two drachms in sixteen fluid ounces of Rectified Spirit. It is a less valuable form of administering Musk than the Mistura; but the pulverized Musk is preferable to either. The powder may be given in doses of gr. v to ʒi, or as much as the stomach can bear.

b. Castor, *Castoreum*, L. E. D. is an animal secretion, peculiar to the Beaver, Castor *Fiber*, an animal belonging to the order *Rodentia* (p. *68). It is a native of the north of Europe, and of Canada, and some other parts of North America. Some suppose the American species to be distinct from that of the North of Europe. The Beaver is characterized chiefly by the incisors, which are orange-coloured anteriorly, and white posteriorly; and by the tail, which is large, flat, covered with a scaly skin, and used by the animal as a trowel in building its hut. The Beaver is an amphibious animal, inhabiting rivers and lakes*.

The Castor is contained in follicles, found in both sexes. They are placed near the pubis, under the skin. There are two Castor follicles; each is covered with a cellular coat, inclosing muscular fibres, intended to compress the follicle. During the life, the Castor is semifluid; but it hardens afterwards. The quantity contained in the sacs is very variable. The best Castor is that which comes from Russia; but it has been very rare of late years; and almost all now found in the market is imported from Canada. The former is in roundish, solid pod-like sacs, smooth on the outside, and, when cut, presenting an orange-coloured surface: the latter is in oblong, thin sacs, corrugated on the outside, and deeper coloured than Russian Castor. They aro in pairs, like two testicles united at the upper end. The Russian Castor, when treated with ammonia, affords a whitish, the Canadian an orange-coloured product.

Castor has a strong, peculiar, somewhat aromatic odour; and a bitter, sub-acrid taste. The odorous principle is dissipated in forming the decoction, which displays an alkaline reaction. Both alcohol and ether take up all the active principles of Castor, and retain its odour and taste. According to Bonn, Castor contains an etherial oil, cholesterine, resin, lime, iron, and some salts: Bouillon Lagrange and Laugier found a volatile oil, benzoic acid, resin, adipocire, a colouring principle, mucus, carbonate of potassa, lime, ammonia, and iron. M. Bizio obtained from it a peculiar crystalline matter, which he called *Castorin*, having tho odour of the Castor, and a styptic taste. Scarcely any is procured from American Castor.

* Règne Animal, t. i, p. 189. London Dispensatory, art. Castor.

Castor is supposed to operate chiefly on the cerebro-spinal nerves. In moderate doses, it causes a sensation of heat in the stomach, and accelerates the pulse; it enters the circulation, and displays the presence of its odorous principle in the urine. Its influence as an antispasmodic was at one time conceived to be considerable; but recent experience has not confirmed this opinion. The dose of Castor is from gr. x to ℈i; but it may be given to almost any extent. It is administered, also, in the form of Tincture.

TINCTURE OF CASTOR. *Tinctura Castorei.* L. E. *Tinctura Castorei Rossici.* D.—It is a simple spirituous solution of the soluble part of the Castor. The dose is f℥i to f℥ii.

COMPOUND TINCTURE OF CASTOR. *Tinctura Castorei composita,* E. is made with Spirit of Ammonia; and contains Assafœtida as well as Castor. It is a superior Antispasmodic to the simple Tincture. The dose is f℥ss to f℥ii.

c. ANIMAL OIL OF DIPPEL.—This is a volatile oil, procured by the distillation of bones, albumen, and gelatin, in close vessels. It floats on the water which passes over; and is easily separated. It is the result of the process. According to the degree of heat employed, it is more or less of a brown colour, transparent, and thick: its odour is strong and unpleasant, yet somewhat aromatic: it is very volatile, partially soluble in water, and greens the vegetable blues. The ammonia, to which this is owing, may be separated by means of hydrochloric acid. All the acids dissolve it, forming imperfect soaps. Strong nitric acid sets it on fire. It combines with alkalies, oil, alcohol, and ether; and is much deepened in colour by exposure to the air and light. It possesses the singular property of burning well in an atmosphere containing only eighteen per cent. of oxygen.

This oil, which received its name from Dippel, a German chemist, who first procured it, was at one time regarded as a powerful Antispasmodic, and employed in epilepsy by Boerhaave, Juncker, and Hoffman. Dippel's oil has, nevertheless, deservedly fallen into disuse, although it is still prescribed on the Continent in cases of symptomatic epilepsy. Alibert made some experiments with it at the Hospital of St. Louis, and found that it prolonged the intervals between the epileptic fits; but it did not appear to diminish the violence of the disease.

d. ASSAFŒTIDA. *Assafœtida,* L. E. D. is the concrete proper juice of the root of the Ferula *Assafœtida,* a native of Persia*, belonging to the natural order *Umbelliferæ.*

It is supposed that Assafœtida is produced by another plant as well as the officinal Ferula, namely, a plant growing in

* Woodville's Med. Bot. 3rd edit. p. 10, pl. 43. London Dispensatory, art. Assafœtida. Richard, Hist. Nat. Med. t. ii, p. 385. Nees Von Esen, 293. Lindley, 45. Amæn. exot. Kæmpf. 535, t. 536.

Syghan, on the northern slope of the Hindoo Coosh mountains, north of Bameean, and which is called, by the natives, Angooza. As far as can be made out, from the description of Dr. Grant, who was surgeon to Lieutenant Wood's expedition to the Exus, it resembles the officinal plant in every point except the root, which is digitate. The officinal plant has a long, fusiform, undivided root, full of white juice, exhaling the odour of Assafœtida. The herb is annual, and consists of large radical leaves, from amidst which rises the flowering stalk, to the height of six to nine feet, naked, and about three inches in diameter, bearing an umbel of many rays. The fruit is flat, thin, of a reddish-brown colour, with three or four vittæ in the dorsal channels. In the recent root, this secretion is in the form of a thick, milky-looking, fœtid juice, which, inspissated by spontaneous evaporation, is the Assafœtida of the shops. It is collected at that season of the year when the stem of the plant is beginning to wither. This is separated, or rather torn from the root, which is then laid bare by digging the earth from it, and sliced horizontally. The milky juice instantly exudes, and, after being left forty-eight hours to inspissate, is scraped off, when a fresh surface is exposed by another transverse slice: and in this manner the root is exhausted.

Assafœtida is sometimes met with in tears, of an irregular flattened form, brittle, and of a pinkish-white colour. More commonly, it is in regular masses, adhering to one another, externally of a brownish-yellow colour, interspersed with shining tears, of a whitish, or reddish, or violet hue. The clearer the mass, the paler the redness, and the more numerous the tears are, the better is the Assafœtida. Both kinds have a fœtid, powerful odour, and a bitter subacid taste. The tears are the finest kind of Assafœtida. By exposure to the air, it becomes brittle; but, even in this state, it cannot be well pulverized unless it be triturated with carbonate of ammonia. It is heavier than water, its specific gravity being 1.327. It softens, at a moderate temperature, to a degree which allows it to be squeezed through cloth, by which means its impurities are separated. At a high temperature, it burns with a white flame. Assafœtida, when triturated with water, forms a milky-looking emulsion, which gradually lets fall the resin. Alcohol, digested on it, dissolves about sixty-five per cent. which is nearly pure resin: the addition of water renders the tincture milky; but it is not precipitated by that fluid. Its odour, and probably much of its medicinal power, depend on the volatile oil, which can be separated by distillation with water: it amounts to scarcely four per cent. Sulphuric ether dissolves the resin and the volatile oil, leaving the gum. Pure Potassa in solution dissolves the whole; and this is also effected by Ammonia. Brugnatelli says that what has been termed gum is extractive; but when the watery

emulsion is shaken in chlorine, no extractive is separated; and no precipitate is produced by protochloride of tin dropped into the aqueous solution. Assafœtida, according to Brandes, contains also traces of phosphorus, sulphur, and several earthy salts, with sulphate of iron. Besides forming an emulsion with water, Assafœtida is soluble in vinegar, proof-spirit, and in the yolk of egg*.

Assafœtida owes its medicinal properties to its volatile oil, which is separated by the digestive power of the stomach, and, entering the circulation, operates on the capillary system. It is a stimulant Antispasmodic. Cullen regarded it, also, as an Expectorant. It operates as an Antispasmodic even when applied externally; and, for this purpose, it is easily formed into a plaster by triturating it with camphor, which promotes its softening. Assafœtida appears to operate chiefly on the spinal nerves, in a manner not well understood: it is equally serviceable, whether taken into the stomach or injected into the rectum. When it disturbs the action of the stomach, the heart, the diaphragm, or the respiratory muscles, there is reason to suspect some organic affection, either of the brain or of the spinal marrow; in which case it should not be employed.

Assafœtida is administered, internally, in the form of Pills, Mixture, Tincture, and Spirit; and, externally, in the form of Plaster.

The usual dose, in the solid state, or as pills, is from five grains to half a drachm:

MIXTURE OF ASSAFŒTIDA. *Misturæ Assafœtidæ.* L. D.—The London College orders fʒv to be triturated with ℈i of water: the Dublin, ʒi with f℥viii of Penny-royal water. This is a nauseous form of giving the medicine. The dose is fʒiv to f℥i.

COMPOUND PILLS OF GALBANUM. *Pilulæ Galbani compositæ.* L. D. *Pilulæ Assafœtidæ.* E.—The quantity of Assafœtida in the London and Dublin preparation is only half of that contained in the Edinburgh; but the latter contains no Sagapenum, which the former contain, in the proportion of three to one of the Assafœtida. The dose is from gr. x to gr. xv, twice or three times a day. Assafœtida, also, enters into the compound aloëtic pill of the Edinburgh College.

TINCTURE OF ASSAFŒTIDA. *Tinctura Assafœtidæ.* L. E. D. —This is a simple solution of the Gum-resin in rectified spirit,

* The ancients used Assafœtida as a condiment, under the name of Silphion and Laserpitium. In Persia, it is still esteemed as a condiment, and mixed with almost all their dishes. Gastronomes, as the French term those who delight in the pleasures of the palate, among the moderns, employ it for the same purposes; having the hot plates on which they eat beef-steaks rubbed with it. The Hindoos use it also as a condiment, and the Arabians consider it as an aphrodisiac. Dioscorides states that the best in his time came from Cyrene. From its smell, it was called Stercor Diaboli.

which is its best solvent. When it is prescribed with water, the oleo-resin is partly separated from the spirit, but is suspended for a sufficient length of time to enable it to be administered with advantage (see p. 159). The dose of the Tincture is f℈ss to fʒi. When it is to be exhibited as an Enema, fʒii to fʒiii may be ordered.

FŒTID SPIRIT OF AMMONIA, *Spiritus Ammoniæ Fœtidus*, L. E. D. is a solution of the Oleo-resin of Assafœtida in Spirit of Ammonia. In the Edinburgh and Dublin formulæ, the Gum-resin is digested for a specific time, and the whole then distilled. In the London process, ℥v of Assafœtida is put into a retort with ʒx of Hydrochlorate of Ammonia, ℥xvi of Carbonate of Potassa, and three pints of Rectified Spirit and the same quantity of water, and the whole distilled until three pints pass over. In this case, the Ammonia is procured by the action of the Carbonate of Potassa on the Hydrochlorate of Ammonia, and passes over in conjunction with the Spirit and the Oleo-resin of the Assafœtida. The dose is fʒi.

THE FŒTID GLYSTER, *Enema Fœtidum*. E. D. may be formed by adding the quantity of Tincture of Assafœtida, indicated in the particular case, to the ordinary cathartic glyster.

PLASTER OF ASSAFŒTIDA, *Emplastrum Assafœtidæ*, E. is seldom ordered, on account of its fœtor.

e. SAGAPENUM. *Sagapenum*. L. D.—This gum-resin is of obscure origin, although it was described by Dioscorides, and stated by him to be the produce of a Ferula growing in Media. Wildenow refers it to the Ferula *Persica*, whilst others regard it as the proper juice of the Ferula *communis*. It is a question of little interest, as the powers of Sagapenum, as an Antispasmodic, are very inferior to Assafœtida. It is imported in masses, and sometimes in tears. The former are made up chiefly of agglutinated tears, semi-transparent, of light-brown colour, tenacious, of an alliaceous odour, and a nauseous, acrid taste. Sagapenum softens with the warmth of the hand. Its constituents, an *Oleo-resin* in various proportions; according to Brandes, 50·3, 37·2 and 37 per cent.; and *Bassorin*. The oil, which can be separated by distillation with water, is of a pale yellow colour, with a strong alliaceous odour; and is the active principle of this Gum-resin.

f. GALBANUM, *Galbanum*. L. E. D. is the secreted juice of a plant yet not known. The London College, on the authority of Professor Don, has named the supposed plant Galbanum *officinale:* the Edinburgh College, on the authority of Dr. Lindley, regard it as probably an Opoïdia. Dr. Lindley examined specimens of a plant from Durrood in Khorasan, brought home by Sir John Mc Neil, with a secretion adhering to them resembling Galbanum, and found them to belong to an umbelliferous plant, of an entire new species, which he named Opoïdia

*balsamifera** : but Dr. Pereira says the concretion did not appear to him to be Galbanum. The Dublin College still refers it to the Bubon *Galbanum*, a native of Asia and Africa†.

Galbanum is brought to Europe chiefly in masses, composed of whitish tears, interspersed in pale brown or yellowish mass; its odour is terebinthinate; its taste bitter, disagreeable, warm, and acrid; its specific gravity 1.212. But the best Galbanum is in tears, of an irregular form, pale yellowish-brown, semi-pellucid, soft, tough, and capaple of being powdered only in frosty weather. Heat softens Galbanum; but it does not melt in a high temperature: it burns with a white flame, exhaling a fragrant odour. Water dissolves about one-fourth of its weight, forming a white opaque emulsion, from which resin is gradually deposited. Alcohol takes up one-fifth of its weight. Its proper solvent is proof spirit. The tincture is of a pale yellow hue, and possesses all the active properties of the Gum-resin. Ether takes up the oleo-resinous part. By distillation, per se, it yields a volatile oil, of an indigo-blue colour, on which the active properties of the Galbanum appears chiefly to depend. Besides the analysis of Pelletier, M. Meisner has given the following as his view of its constituents: Resin 65.8, Gum 22.6, Cerasin 1.8, Malic Acid 0.2, Volatile Oil 3.4, Impurities 6.2, in 100 parts. The volatile oil can be separately obtained by distillation with water: it is yellow, and is the odorous principle of the Galbanum. Galbanum enters into the composition of plasters and a tincture. It may be given in doses of gr. x to ʒss.

Plaster of Galbanum, *Emplastrum Galbani*, L. D. is a compound of Galbanum· Litharge Plaster, Turpentine, and Frankincense. It operates as an Excitant, promoting suppuration in indolent tumors.

Compound Pills of Galbanum, *Pilula Galbani composita*, L. D. is a compound of ℥i of Galbanum, ℥iss of Myrrh and of Sagapenum, and ℥ss of Assafœtida. The dose is from gr. x to ℈i.

Tincture of Galbanum, *Tinctura Galbani*, D. is made by digesting ℥ii of Galbanum in Oii of Proof-spirit for seven days, and filtering. The dose is ʒi to ʒii.

Galbanum also enters into the composition of the *Pilulæ Assafœtidæ*, E. and the *Emplastrum Gummosum*, E.

g. Opoponax. L. D.—The plant which yields this gum-resin, is also a Ferula, according to Sprengel; De Candolle, whose authority is followed by the London College, says it is the production of the Opoponax *Chironium*; a native of Greece, Italy, and the South of France‡. It is procured both from the

* Botanical Register, Aug. 1, 1839. † Elements of Mat. Med. p. 1055.

‡ Woodville's Med. Bot. third edit. p. 122, pl. 47. London Dispensatory, sixth edit. art. Pastinaca. Richard, Hist. Nat. Med. ii, p. 353. Lindley, 44. Nees von Esen. 292.

stem and the root. When inspissated, it is of a reddish-yellow colour, variegated with large white pieces. It forms a milky solution with water; but one-half of the Opoponax only is taken up, and the emulsion gradually deposites resin. Proof spirit is its proper solvent. According to Pelletier, it contains 42 resin + 33 gum, + 4 starch, + 5 volatile oil, + 16 lignin, = 100. As an Antispasmodic, it is inferior to Assafœtida, and is seldom prescribed.

h. VALERIAN ROOT, *Valeriana,* L. E. D. is the root of Valeriana *Officinalis,* a plant which is a native of Greece and the temperate parts of Europe, belonging to the natural order Valerianaceæ*. The rhizome of Valerian is tuberous, and gives origin to numerous radical fibres, which are about the size of a crow-quill, and three or four inches long; when dried, of a yellowish-brown colour. The plant rises about four feet high, with pinnate leaves, the leaflets coarsely serrated. The flowers are in cymose, contracted panicles, with ovate-lanceolate, acuminate, herbaceous bractes. The radicles are the officinal part: they should be dug up in autumn; and have a peculiar penetrating odour, which is strongest after they are dried; and a bitter and acrid taste.

In high situations, Valerian roots contain not only more volatile oil, but that which they possess is of a more stimulant nature than when the plant grows in low and moist situations; and those plants only ought to be employed which are grown on elevated spots†.

The strong peculiar odour of Valerian is due to its volatile oil of the roots; in a confined situation, it affects strongly the brain, and produces symptoms of intoxication in quadrupeds, especially the cat, who is powerfully attracted by it. Tromsdorff analysed Valerian, and obtained 12.5 of a peculiar principle, soluble in water, but insoluble in alcohol; 6.2 of a soft, dark-coloured resin; 1.2 volatile liquid oil; 9.3 of gummy extract, and 71 lignin, = 100‡. The volatile oil, when separated by distillation, is pale green, has an odour resembling camphor, and an aromatic, bitter taste; its sp. gr. is 0.934: it is always combined with a peculiar fatty acid, which has been named Valerianic. The volatile oil is the active principle of Valerian. It is therapeutically used in Germany.

Valerian operates as a powerful excitant to the nervous system; a fact illustrated by its intoxicating property on cats. In large doses, it induces an acceleration of the pulse, elevation of the temperature of the body, vertigo, restlessness and agitation. It

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* Woodville's Medical Botany, third edition, pl. 77, p. 32. London Dispensatory, art. Valeriana. Richard, Hist. Nat. Med. t. ii, p. 270. Lindley, 471. Hayne, iii, 32.

† It is cultivated for medicinal use at Ashover, Derbyshire.—Encycl. Agricult. p. 954.

‡ Bulletin de Pharmacie, t. i.

is, however, inconstant, in reference to its effects, either as a simple Excitant or an Antispasmodic; a circumstance, however, depending on the condition of the patient.

Valerian is administered in the form of powder, infusion, and tincture. The dose of the powder is gr. xx to ℈ii.

Infusion of Valerian, *Infusum Valerianæ,* L. E. D. is made with ℥ss of the root, and a pint of boiling distilled water. The dose is f℥i to f℥ii. Although it possesses some of the active properties of the plant, yet it is undoubtedly less powerful than either of the tinctures.

Tincture of Valerian, *Tinctura Valerianæ,* L. E. D. is made with ℥v of the bruised root and two pints of Proof-spirit. The dose is from m. xxx to f℥ii.

Compound Tincture of Valerian, *Tinctura Valerianæ composita,* L. is made with the same proportions of ingredients as the Alcoholic Tincture, using the Aromatic Spirit of Ammonia instead of the Rectified Spirit. The dose is f℥i to f℥ii. This is the best of the officinal Tinctures.

All the Gum-resins belonging to the natural order Umbelliferæ are Antispasmodic. They are combinations of resin, gum, extractive matter, volatile oil, and some other substances. The resins and oils are soluble in alcohol; the gum and extractive in water: hence, proof-spirit is the proper solvent of gum-resins. They are soluble also in the alkalies; but not in sulphuric ether. The following table displays, at one view, the composition of the antispasmodic Gum-resins.

Components in 100 parts.	Assafœtida according to Pelletier.	Galbanum according to Pelletier.	Sagapenum according to Pelletier.	Opoponax according to Pelletier.
Resin	65.00	66.86	54.26	42.0
Gum	13.60	19.80	33.34	33.4
Volatile oil	3.60	——	10.20	5.9
Wax	——	——	——	.3
Extractive	——	——	——	1.6
Fecula	——	——	——	4.2
Lignin	——	——	——	9.8
Bassorine	11.66	——	——	——
Malate of lime	0.30	——	——	——
Malic acid	——	——	——	2.8
Loss	5.04	4.34	2.20	——

k. Common Wormwood. *Artemisia absinthium.* L. E. D.—Wormwood is an indigenous plant; and a native, also, of many other parts of Europe, the Crimea, Siberia, Barbary, and Newfoundland. It belongs to the subdivision Asteraceæ of the natural order Compositæ. It grows on waste lands and on the

road-sides; but it is also cultivated for medicinal use. The root is perennial; the plant an undershrub, covered with a silky, hoary down. The *leaves* are trissinnatisect, the segments lanceolate and obtusely dentate, green above and hoary beneath; the flowers are in small, racemose-puniculate, nodding heads, of a pale yellow colour. The leaves, flowering heads and twigs, are officinal, and should be collected when the flowers are running to seed. When dried, they have a whitish-grey colour; a velvety feel; a powerful penetrating odour; and an intensely bitter, somewhat aromatic, taste, both of which are imparted to water and to rectified spirit. According to Braconnot, the active components of wormwood are *volatile oil, green resin, bitter resin, albumen, starch, azotized and bitter azotized matter, absinthate, nitrate* and *sulphate* of *potassa*, and *chloride* of *potassium**.

Wormwood operates as a powerful Antispasmodic when spasmodic action is accompanied by a generally debilitated condition of habit. The best form of administering it is in powder or infusion. The dose of the powder is from gr. x to ʒi. The infusion may be made with ʒiv of the herb to Oi of boiling water. The dose is f℥iss.

Extract of Wormwood, *Extractum Absinthii*, D. is a simple aqueous extract; but, as the aroma is dissipated during the evaporation, it is a simple bitter, and has lost much of the antispasmodic influence of the plant. The dose is gr. x to ℈i.

l. Diluted Hydrocyanic Acid. *Acidum Hydrocyanicum dilutum*. L. *Acidum Hydrocyanicum*. E. *Acidum Prussicum*. D.—This acid, the chemical properties of which have been already examined (p. 317), operates as an Antispasmodic, when spasm depends on irritability: and it is by subduing that condition of the nervous system only, that it can hold a place in this class of medicines. The dose of the London preparation is m. iii to m. viii; that of the Edinburgh and Dublin, m. i to m. v.

m. Sulphuric Ether. *Æther Sulphuricus*. L. E. D.—Ether (p. 133) has undoubted claims to be ranked as an Antispasmodic; its influence as such, depending on its powerful and diffusible excitant properties; but, like all diffusible stimulants, its action is transient. It is taken into the circulation, and pervades every tissue of the body. The menstruum in which Ether is administered must depend on the state of the habit of the patient at the time: but when its simple antispasmodic influence is required, water, in the proportion of fourteen parts to one of Ether, is the best vehicle: but, when pain accompanies spasm, it may be administered in combination with Tincture of Opium or the Salts of Morphia. In spasmodic affections of the bronchi, as in spasmodic asthma, it may be inhaled. Both the

* Bul. de Pharm. t. v, p. 549.

simple and compound spirits of Ether operate as Antispasmodics, in the same manner as Ether. The dose of ether is m. xx to f℥i.

n. OIL OF AMBER, *Succini Oleum*, L. D. is a pyrogenous oil, procured by destructive distillation from Amber.

Amber, *Succinum*, has been regarded as a gum-resin; but the analysis of Berzelius has separated it from the gum-resins. It may, however, be regarded as a modification of resin, as it has more analogy to resin than to any other substance. It is found in various parts of the world—Sicily, Maryland, and in Russia, near Kahin; but in greatest quantity in coal strata, on the shores of the Baltic; it is thrown up by storms, and is found floating on the banks of Samland, near Pillaw. There are two sub-species:—1. White Amber, which has a pale straw colour; 2. Yellow, which has the colour of yellow wax, passing into yellowish-brown and hyacinth-red. It is a brittle, transparent, light, inflammable substance, insipid, with a slightly fragrant odour when it is pulverized; possessing considerable lustre, and a sp. gr. 1.065: it is scarcely soluble in water at any temperature; slightly so in alcohol; it dissolves in boiling liquor potassæ, and forms a saponaceous solution, not decomposed by water. Sulphuric acid acts upon it in the cold, converting it into a dark-coloured, resinous mass: nitric acid does not decompose it, but, by long boiling, dissolves it. Hydrochloric acid and the weaker acids do not act upon it. Berzelius found it to contain—a small quantity of volatile oil; another resin, little soluble in cold alcohol, but soluble in boiling alcohol, ether, and alkalies; and a principle closely resembling *lac*.

When Amber is distilled, an oil and an acid come over. This oil, redistilled, has a strong ungrateful odour, and a hot, acrid taste; is light, volatile, and imflammable; insoluble in water, and only partially soluble in alcohol. It resembles naphtha more than oil.

Oil of Amber possesses antispasmodic powers, and was formerly administered, internally, in doses of from five to twenty minims, diffused in aqueous fluids by means of mucilage. It is now scarcely ever used, except externally, as the active ingredient in some empirical embrocations: one of these, *Roche's Embrocation*, which M. Brande informs us is a compound of equal parts of Amber and Oil of Cloves, dissolved in two parts of olive oil, has obtained much celebrity as a topical application in hooping-cough.

* * INORGANIC SUBSTANCES OPERATING AS DIRECT ANTISPASMODICS.

BITUMENS.—These are inflammable substances, found either in the earth or issuing from its surface. The medicinal Bitumens are Naphtha and Mineral Tar.

o. Naphtha is found in various parts of the world. On the shores of the Caspian, and in Italy, it is abundantly procured. In the year 1802, a considerable spring of it was discovered at Amiano, in the state of Parma. It is used in Genoa to feed lamps, instead of oil. In Persia, Naphtha is found so pure, that, without rectification, it is fit for preserving potassium and sodium from the action of the air. Naphtha is also produced in the manufacture of coal-gas. When pure, it is a fluid of great limpidity; its odour is agreeable to most persons; it is very volatile, and considerably lighter than water, having a specific gravity of 0.850; and, when highly rectified, of 0.750. It expands gently in the air; and, like Ether, forms an atmosphere which inflames on the approach of any ignited body. In burning, it exhales a thick smoke, and leaves no residue. It does not congeal at zero; but, when it is kept exposed to the light and air, it becomes thick, brown, and approaches in character to Petroleum. In truth, these two substances, Petroleum and Naphtha, are modifications of one another. We can trace the transition from Naphtha to Petroleum: but Naphtha contains no oxygen, and is therefore used to preserve the rapidly oxidizing metals. It consists of six eq. of Carbon $= 36.72, +$ five of Hydrogen $= 5$, making the equivalent $= 41.72$.

Naphtha was formerly much employed as a therapeutical agent; it is an excitant, operating on the mucous membrane of the intestinal canal, the kidneys (the secreting powers of which it augments), and on the urinary organs. In large doses, it seems to suddenly exhaust the nervous irritability, in which and many other respects it resembles the volatile oils, particularly oil of turpentine, in its physical influence on the habit; and, like turpentine, it has been advantageously administered in tape worm.

*p. Petroleum** is found in several parts of this island: at Armskirk, Dal in Derbyshire, and at Catherine's Well near Edinburgh; in Italy, in North America, and in Barbadoes and Trinidad. It is more opaque and more unctuous to the touch than Naphtha. The substance called *Barbadoes* tar is Petroleum. It is semi-fluid, of a dark, brownish-green colour; has somewhat of the odour and taste of Naphtha. It is lighter than water; is combustible, and soluble in water. It differs from Naphtha in containing both Oxygen and Nitrogen. Some kinds of Petroleum, especially that of Rangoon, as investigated by Dr. Christison and Dr. Gregory, contains Paraffin and Eupion†. Petroleum combines with fat, resins, volatile oil, and camphor. It acts on the habit like Naphtha.

q. CARBONATE OF AMMONIA, *Ammoniæ Sesquicarbonas.* L. *Ammoniæ Carbonas.* D. (p. 189.)—operates as an Antispas-

* This term is derived from *Petra*, a rock, and *Oleum*, oil; hence the word implies *rock oil.*

† Trans. Royal Soc. of Edinburgh, xiii, p. 1.

modic nearly on the same principles that govern its influence as an excitant. In that irregular action which induces the globus hystericus it has been found especially beneficial. The dose is from gr. v. to ℈i.

r. Oxide of Zinc. *Zinci Oxydum.* L. E. D.—This is the Pompholyx of Galen, and the Nihil album and Lana philosophica of the older chemists. It is a white, soft, inodorous, tasteless Oxide; insoluble in water, but soluble in concentrated solutions of pure Alkalies. At a low red heat, it becomes yellow, and acquires a slight odour of Garlic; but both the colour and odour disappear as it cools. It is a compound of one equivalent of each of its components Zn O, equiv. = 40·3, or, according to Berzelius, of 80·1 of Zinc, + 19·9 Oxygen, = 100·0.

According to the London and Edinburgh Colleges, this Oxide is prepared by throwing it down from a solution of Sulphate of Zinc, by means of Carbonate of Ammonia, collecting, washing, and drying the precipitate, and, lastly, exposing it to a red heat to drive off the Carbonic Acid. According to the Dublin College, the Metallic Zinc, in small fragments, is thrown into a crucible, heated to whiteness, whilst another is inverted over it, so as to admit the air, and collect the oxide, which is volatilized as it is formed.

The purity of the Oxide is determined by dissolving it in Nitric Acid, and adding to the diluted solution Nitrate of Baryta, which will detect any sulphate present by forming a white precipitate insoluble in Nitric Acid; lime is made apparent by adding Carbonate of Ammonia; and carbonate of lead by Sulphuretted Hydrogen gas. The dose of the Oxide, as an antispasmodic, is from gr. i. to gr. xii.

s. Ammonio-Sulphate of Copper. *Cupri Ammonio-Sulphas,* L. *Cuprum Ammoniatum,* E. D.—This is violet-blue powder, which exhales the odour of Ammonia, and has a strong styptic, metallic taste. In its recent state, it dissolves readily in water; but if it has been kept for some time, and some of the Ammonia has evaporated, it is only partially soluble, an insoluble disulphate of Copper being formed. The Ammonio-Sulphate is prepared by rubbing together an ounce of Sulphate of Copper and half an ounce of Sesquicarbonate of Ammonia, till all effervescence ceases, and then drying the product in bibulous paper, without heat. The chemical nature of the compound is not well understood. By some it is supposed to be a mere mixture of Sulphate of Copper with Carbonate of Ammonia, the latter being in excess*; by others it is regarded as a mixture of Sesquicarbonate of Ammonia, and a double Sulphate of Ammonia and Copper†.

* Phillip's Transla. of Lond. Pharm. 1836. † Christison's Dispensatory, p. 388.

This preparation operates as an Antispasmodic, chiefly by its tonic influence. The dose is gr. ss to g.ii. There are two officinal preparations of it.

SOLUTION OF AMMONIO-SULPHATE OF COPPER. *Liquor Cupri Ammoniæ sulphatis*. L. *Cupri Ammoniati Aqua*. E.D.—This is a filtered solution of ʒi of the salt in a pint of distilled water. It is an external application.

PILLS OF COPPER. *Pilulæ Cupri Ammoniati*. E. This is a convenient mode of prescribing the salt. Dose, gr. ss to gr. iii.

B. INDIRECT ANTISPASMODICS.

* *Ponderable Agents.*

TONICS AND NARCOTICS.—With respect to Indirect Antispasmodics, I have little to say: they consist chiefly of Tonics and Narcotics. In selecting them, we must be guided by the condition of the patient, and the nature of the exciting causes of the spasms which they are intended to relieve. If these be the result of local irritation, kept up by habit after the irritating cause is removed, then *Narcotics*, by allaying this irritation, and breaking the habit, are undoubtedly the best Antispasmodics; but, if the spasms are maintained, not so much by habit as by a peculiar susceptibility of impression, which is always more or less connected with debility, then *Tonics* are to be preferred; and the sooner the body can be brought under their influence, the better.

* * IMPONDERABLE AGENTS.

Mental Influences.

FEAR.—In no instance is the remedial influence of mind more strikingly illustrated than in spasmodic diseases. I have already endeavoured to explain in what manner elevating passions, such as *Joy* and *Impetuosity*, operate upon the nervous energy as material stimulants; and, if we admit this to be true, we can have little difficulty in comprehending that the depressing passions may operate as direct sedatives. In order to understand how *Fear* produces an Antispasmodic effect, it is necessary that we should clearly comprehend the meaning of the term, as it is sometimes confounded with *Apprehension* and *Terror*. Apprehension implies a dread of something which hangs over the future, but is not immediate: Terror, the dread of some danger so immediate as to threaten instant destruction, but which, nevertheless, is of a nature to rouse a voluntary

effort for self-preservation; or it may be of a kind which presents no prospect of hope, and which, consequently, paralyzes the nervous energy to such a degree, that an instantaneous cessation of every vital function may result, and death follow. *Fear* is an intermediate state—one which contemplates the cause, and in which, as no immediate effort of muscular energy is necessary to be exerted on the voluntary muscles, these share the general torpor of the rest of the body, evidenced in the corporeal effects of this passion.

When a person is suddenly alarmed, the blood recedes from the surface, which instantly becomes pale, the respiration ceases, the action of the heart is so much weakened that it does not expel half its contents; the pulse becomes small and quick; and a sensation of chilliness is felt over the whole of the skin. But, during this period, the muscular power, in several parts, is suffering a kind of temporary spasmodic contraction; the abdomen is drawn inwards, whilst the breath is suspended; the arms and the limbs are fixed in the position they assumed at the moment of the alarm; and, whilst this continues, spasm, instead of being relaxed, is confirmed. Such a state, however, cannot long continue; and the natural consequence of so powerful an excitant is a corresponding state of collapse: every muscle is relaxed, and those which were previously in a state of spasmodic contraction, necessarily share in the change which has taken place. Two queries arise upon this explanation—has the resolution of a morbid contraction of muscles ever resulted from the influence of Fear? Can we employ this agent as an Antispasmodic? In replying to the first query, I say that we see its effects in resolving spasm by its influence on the sphincter of the bladder, so that a smaller than usual stimulus of the urinary secretion is required to cause this muscle to yield; a well-known effect of Fear being a frequent and involuntary discharge of urine; and, perhaps, the diarrhœa which also commonly attends Fear, may be explained on the same principles. If, therefore, few direct cases of Fear having actually relaxed morbid spasm can be brought forward, still what is known of its effects is sufficient to prove that it exhausts the nervous energy and produces a state of collapse, so sudden that the relaxation of spasm cannot fail to follow; and there is certainly no reason why so powerful an agent should not be employed when other and more ordinary means fail. I recollect a striking instance of its sanative influence in hooping-cough kept up by the habit. The patient, a young boy, was threatened with the application of a large blister: it was not applied, but merely placed within his view; nevertheless, the dread of it completely removed the cough. Boerhaave also cured epilepsy in a whole school, by displaying, at the moment of the expected attack, a red-hot poker, which he threatened to push down the throats of

those who should have a fit. It is the duty of the physician to take advantage of every means likely to destroy diseased action; and it is wonderful that, in some spasmodic affections, Fear has not been more employed as a remedy.

Abstraction.—If there are few cases to illustrate the influence of Fear as an Antispasmodic, many might be brought forward to demonstrate the powerful effect of abstracting the attention in cases of spasm. The explanation of this is not difficult. We can have no sensation of any kind without a perception of the mind, connected with the impression which originates the sensation. Thus, a part of the body is touched with a hot iron: the pain is the consequence of the attention being roused, and the mind receiving a perception of the injury; and the continuance of the pain is chiefly the result of an effort of the mind detaining the perception, to the exclusion of every other object that solicits its notice. Now, if any more powerful impression can be made, so as to abstract the mind from this perception, while the effect thus produced continues, the pain is not felt; and it is only when this quickly ceases to occupy the attention, that memory operates in again directing the mind to the seat of pain, and renewing the sensation. That this is a purely mental operation will not appear extraordinary, if we reflect on the evanescent nature of many impressions which are the causes of distinct efforts of the mind and yet cannot be recollected—nay, even appear never to have been present to the mind. Thus, if we are reading aloud, every letter and every combination of letters must produce a distinct impression; yet, the attention being directed to the meaning of the pages, and not to the letters and words, there is no consciousness, or rather no memory, of the impressions ever having been made, although it is possible that two thousand letters may have been objects of perception in the space of every minute. Now, in the case of spasmodic action, the mind is directed solely to the seat of the spasm; and, as long as this exists, no corporeal agents that do not cause an impression greater than that which has been produced by the spasm can in any degree relieve it; but, abstract attention from the seat of the spasm, and the spasm is instantaneously resolved. This is beautifully illustrated in the reduction of luxations. A man has his shoulder luxated; various ineffectual attempts are made to reduce it, owing to the spasm which has supervened, and which is maintained by the attention of the patient being directed solely to the part; abstract the attention by any means, the spasm instantly yields, and the head of the humerus slips into its socket. It is unnecessary to pursue the subject farther: there is no doubt that both Fear and sudden Abstraction of Attention may be successfully employed as Antispasmodics; but, in admitting this, we must, at the same time, confess that great discrimination

and judgment are requisite to determine the circumstances under which their employment is applicable.

Practical Employment of Antispasmodics.

Antispasmodics are indicated in one class of diseases only, namely, those attended with inordinate muscular action; but it is more particularly in those in which the spasms or convulsions are the result of transitory or accidental irritation, that they prove most beneficial.

Convulsions, generally so called, may originate from a variety of causes; and the operation of these are often modified by the condition of the individual in reference to age, sex, and temperament. The primary cause of general Convulsions is undoubtedly, in every instance, the irritability of the nervous system: but it is of great practical importance to ascertain whether this is independent of, or connected with, increased vascular action of the cerebro-spinal centres, and in what part of the system the exciting cause is seated, or whether it be extraneous to the body. In general, the *indirect* antispasmodics, in such cases, are more indicated than the *direct.* Indeed, it is astonishing how inefficient even the most powerful, such as Musk and Assafœtida, for example, are in general convulsions, unless the convulsions continue after blood-letting and a course of Cathartics; even in such cases they merely mitigate the violence of the paroxysm. In Infantile Convulsions, which are generally connected either with dentition or visceral irritation from worms, or other spasmodic diseases, such, for example, as Hooping Cough, or some eruptive fevers, they are certainly less doubtful remedies during the existence of the paroxysm. Besides the warm-bath,—dashing cold water on the face and head, and the administration of Calomel and purgatives,—an enema, containing from ℥ss to f℥iss of the Assafœtida Mixture, generally abates rapidly the violence of the paroxysm; but it must be always remembered that this is merely palliative treatment during the paroxysm, and that the causes of the convulsions are still to be searched out and removed.

In very irritable states of the bowels, the compound Chalk mixture with gr. ss or a grain of Musk, has proved permanently useful. But every case requires a distinct plan of management.

In *Tetanus*, the great advantage of Opium, as a narcotic or an *indirect* antispasmodic, has been fully stated; among the *direct* antispasmodics, Musk has been tried with some slight appearance of advantage; but when this is compared with that produced by Opium, it is thrown wholly into the shade. Even great as is the acknowledged value of Opium in this disease, its most strenuous advocates can only boast of its partial or occasional success, in cases where the patience of the practitioner

was such as to carry on his employment of it to the tenth or twelfth day, in doses which almost exceed credibility; but when we speak of direct Antispasmodics, we are constrained to admit that no reliance can be placed upon their influence in tetanic affections.

In another disease of rare occurrence, *Catalepsy*, in which permanent contraction takes place in muscles, with a suspension of volition and consciousness, but in which the contraction is of a passive character, permitting the body to be moulded into every form, and placed in every position almost as if it were a jointed doll, Antispasmodics have been expected to prove beneficial, but certainly have produced no marked advantage. Even in *Ecstacy*, in which the contractions are of a positive description, or the limbs become passive, whilst the state of consciousness is the same as in Catalepsy, Valerian, Musk, and Assafœtida have produced no benefit whatsoever during the paroxysm. Although the real condition of habit predisposing to these states be unknown, yet it is with much probability supposed to be one of excessive momentum; and this opinion is the more likely, as the persons complain of headache, confusion of ideas, flushings of the face, and tenderness on pressure in the course of the spine. The object, therefore, of the practitioner is to subdue this state, and afterwards to allay the morbid irritability of the nervous system by a course of Tonics, and direct Antispasmodics during the intervals of the attacks.

In *Chorea*, as already described, the spasms differ from those of Tetanus, and are rather irregular continuations of voluntary action than real convulsions. The disease is one of debility, and generally attacks children, and those under the age of puberty. It has been supposed that the spasmodic action may depend on visceral irritation; and, impressed with such an opinion, Sydenham proposed the employment of purgatives; and his method of treatment was some years ago revived by Dr. James Hamilton. This excellent physician, however, carried his plans too far; and administered purgatives in too large doses, with little or no benefit in Chorea. Direct Antispasmodics have been tried with as doubtful advantage, and have yielded their place to Tonics in the management of Chorea. In this respect, Carbonate or Sesqui-oxide of Iron may be justly regarded as an indirect Antispasmodic. It is true that cases are recorded which have yielded to direct Antispasmodics, after Tonics had failed; but, in general, Antispasmodics are not to be depended upon in Chorea.

Antispasmodics have affected little in *Epilepsy* of an idiopathic kind. When the disease does not depend on mechanical irritation in the brain or other organs; but is an attendant on mania; or connected with uterine irritation; or irritation from worms; or does not follow the sudden repulsion of eruptions;

or, in a few words, is merely functional; then Antispasmodics, both direct and indirect, may be prescribed with advantage. When the disease is grafted on Hysteria; or an hysterical temperament in men; Musk is the direct Antispasmodic. It has been highly extolled; but, although in some instances it has been productive of the most beneficial results, yet in others it has completely failed. When the disease is periodical, and obviously connected with some functional derangement of the nervous system, Musk is likely to prove beneficial; but it is scarcely requisite to say that if any organic lesion within the cranium exists, or if hypertrophy of the left ventricle of the heart be present, nothing can be expected from Musk. I have seen it most useful: but it must be genuine, and the dose carried to its full extent. In a very severe case, which I attended, the dose was gradually carried to one drachm, and repeated every sixth hour. The intervals between the paroxysms were protracted, and the attacks lessened from three in the course of a day to a single attack in six weeks.

In this mode of administering Musk, I have no hesitation in recommending it strongly to notice. It may be applied to a blistered surface, in doses of from gr. v to x, with the same advantage as when it is taken into the stomach*.

Stramonium, Oxide of Zinc, the Salts of Mercury and of Copper, and Arsenious acid, have been employed as indirect Antispasmodics in Epilepsy. I have lately prescribed the Artimesia *vulgaris*, in powder, in doses of ℈i to ʒi, with much advantage. The Metallic Tonic, on which I place most reliance as an indirect Antispasmodic in Epilepsy, is Nitrate of Silver: it proves most beneficial in those cases in which it opens the bowels.

In *Asthma*, the direct Antispasmodics have proved highly beneficial, especially in the spasmodic form of the disease, unless it depends on a peculiar predisposition connected with original conformation, in which case it is incurable. Among the direct Antispasmodics, useful in this disease, we may rank Assafœtida as the first, provided no inflammatory condition of the habit exist at the time of prescribing it, in which case it proves hurtful. It possesses, when it is indicated, the double advantage of being both Antispasmodic and Expectorant. It does not augment the bronchial secretion; and by affording a moderate degree of stimulus to the secreting follicles, it changes the character of the sputa; renders it much less tenacious, and, consequently, much more easily expectorated.

As indirect Antispasmodics, in Spasmodic Asthma, every thing may be obtained from Opium and Stramonium. The spasm of genuine Spasmodic Asthma will rarely resist a full

* Dict. de Med. et Chirurg. pratiques.

dose of Opium: it must be administered in the liquid form; and no preparation of the drug answers so well as the old liquid Laudanum of Sydenham. Stramonium, as I have already stated, proves most serviceable when it is smoked; and I have no doubt that the watery extract of Opium added to it, as I have had many opportunities of remarking, will be found to aid greatly the influence of the Stramonium. In old Asthmas, the Tincture of Valerian displays a marked influence in relieving the paroxysm; and, in conjunction with the Salts of Iron, in the intervals, if no inflammation be present, it protracts the period of its return.

In *Hooping Cough*, the direct and also the indirect Antispasmodics have been much employed. The preference has been given to Assafœtida, Castor, Musk, oil of Amber, and Camphor, among the direct; and Opium, Digitalis, Belladonna, Conium, Arsenious acid, Nitrate of Silver, Acetate of Lead, Bark, and the salts of Quina, among the indirect. The influence of some of them I have already stated under the class Narcotics. I have certainly observed benefit to arise in the second stage of the disease both from genuine Musk, and an artificial preparation composed of oil of amber and nitric acid, which has been regarded as a species of artificial Musk, and has been administered internally and also applied to the skin. It does not operate as a counter-irritant; and, therefore, its antispasmodic properties are altogether due to its influence on the cutaneous nerves, and the sympathetic propagation of this to the system. I have seen much advantage result from the use of Oxide of Lime dissolved in Liquor Potassæ; and also from Mental Antispasmodics. The influence of the latter is too much overlooked.

In *Colic*, the benefit to be expected from Antispasmodics depends on the exciting cause of the attack. In simple constrictions of the canal, Narcotics answer every indication; but when flatulence is the exciting cause, the direct Antispasmodics are indicated.

Antispasmodics are supposed to be peculiarly adapted for relieving Hysteria. Although this Protean disease depends frequently on an irritable condition of the uterine system, and occurs in females chiefly at that period of life when irritability is in excess, and every impression, both corporeal and mental, operates most powerfully on the excitability of the nerves, yet the character of the disease is very greatly modified by the degree of relaxation or of tone of the person at the time of the attack.

Hysteria sometimes attacks males, in whom it seems to depend either on original conformation; or on causes that have weakened the general habit, and produced an unusual excitability of the nervous system. In the treatment of the disease, it is of primary importance to ascertain the state of the habit of the

patient; and how far the disease is connected with, or dependent on, a plethoric or a debilitated condition of the habit; or on uterine disorder; or on gastro-intestinal affections; or on that morbid susceptibility of impression which often arises from improper education, and fostering the sympathies of our nature to an inordinate extent. With the exception of those cases which demand blood-letting, the treatment of the paroxysm is the same in all. The direct Antispasmodics, in full doses, may be administered at the commencement or during the existence of the paroxysm: but in the intervals, the indirect, especially Tonics, will be found to diminish the susceptibility of the nervous system most effectually. The only difficulty is to select that Tonic which is best adapted to the individual case. I have found a combination of Tonics and Narcotics most useful: and, as hysterical patients object to vegetable bitters, and fancy that Chalybeates do not agree with them, the diluted Sulphuric Acid with Tincture of Henbane, administered in the infusion of Conserve of Roses, answers almost every intention which can be fulfilled by indirect Antispasmodics. The compound Tincture of Valerian, in combination with Chalybeates, has proved most efficient in cases of much nervous irritability, with a weak and languid circulation, and an hysterical diathesis. It calms the general mobility of the habit, and averts the tendency to the hysteric paroxysm. When preparations of Iron can be given, nothing can surpass the influence of the Tincture of the Hydrochlorate, taken about an hour before the use of the shower bath, either immediately on rising in the morning or at noon. In almost every case of Hysteria, the object is not to relieve the spasmodic affection when it is present, but to give that tone to the system which shall render the patient less susceptible of ordinary impressions acting as morbid influences.

I have hinted at the influence of mental affections operating as Indirect Antispasmodics; but it would be more correct to regard them in a negative point of view, or as abstracting the attention from the existing condition of the habit, than as operating by any direct influence. Thus it often happens, that luxations cannot be reduced whilst the attention of the patient is directed to the affected joint; as this keeps up the spasmodic action of the muscles, which opposes the reduction of the luxated joint: but if the attention of the sufferer can be diverted to any extraneous object, the spasm instantly gives way, and the joint slips into its place. I have more than once observed the same thing prevent the introduction of a bougie into the bladder, in spasmodic stricture; but, on suddenly kicking down a chair, or by any other means, arresting the attention of the patient from the seat of the disease, the instrument has instantly entered the bladder. A sudden shock has instantly arrested hiccup: and it is probably to this influence on the mind that

we must ascribe the powerful antispasmodic effect of dashing cold water on the face in Hysteria; and throwing it on the legs and the genitals in obstinate constipation of the bowels, or in retention of the urine, from spasm affecting some portion of the intestines in the former, and spasmodic constriction of the sphincter of the bladder of urine in the latter: in both, the spasm instantly gives way.

SECTION VIII.

TONICS.

The medicinal agents known by this term are of great importance, and most extensive utility; they are intended to restore the strength and vigour of the body, when it is weakened and relaxed. The name of the class is derived from the Greek word τόνος; which, beside *tone* or *accent*, means also *tension*. This class is frequently termed Corroborants.

The term *tone* is synonymous with that of *health;* it consists in a certain degree of firmness and tension of the living animal fibre, which gives it *elasticity*, or power of resisting extension; and of restoring again its former state when the distending power is removed; *strength*, or the capability of opposing those causes which tend to weaken or destroy the continuity of its parts; and endows it with *contractility*. When the animal solid is in this condition, the muscles or moving organs act regularly and powerfully; whether they are internal and involuntary, or external and under the control of the will. This is, therefore, the condition of *healthful* tone. When the opposite state exists; when the substance of the body feels soft and flabby, and the action of the involuntary muscles is languid and imperfect, whilst the voluntary do *not readily* respond to the will; and when the ordinary movements of the body are performed with difficulty, and there is a strong inclination for rest and indulgence, this is a state of *deficient* tone or *debility*. This condition of the animal fibre has been demonstrated by experiments: thus, if the same muscles of two animals, of equal size and age, but the one healthful and the other weak, are detached from the bodies of the animals, and weights appended to them, the muscle taken from the healthy animal, or that in the state of *tone*, will sustain a much greater weight than that taken from the animal in the opposite state, that of *defective tone*. But it must also be mentioned, that this condition of the

animal solid is truly the result of vital energy; for the muscle which can support a certain weight, when just separated from the body, loses the power of sustaining it a short time afterwards; and this power continues to diminish in the ratio of the distance of time from that of the detachment of the muscles from the living body. Medicinal agents, which restore relaxed and weakened muscles to their state of healthful tone, which renew their *elasticity*, *contractility*, and *tension*, are those which are correctly termed *Tonics*. But the action of Tonics is not confined to the muscular fibre; the *blood* also shares in their influence, especially when it becomes defective in the two important elements of fibrin and albumen. It is evident that, as the blood derives its formative materials from the *chyle* and the *lymph*, it must be defective in its components, if the *digestive* and capillary functions languish: and it cannot continue in its normal condition, if the excretions be not duly expelled by the lungs, the abdominal viscera, the kidneys, and the skin. The action of Tonics tends to restore the organs, necessary for these functions, to their healthful condition when they languish. The Tonics which operate in supplying the blood with its organizing and assimilative principles, have, sometimes, been termed *Analeptic Tonics*. On the same principles, Tonics influence the nervous system. Hence, the operation of Tonics is not confined to one part, but extends to the whole of the system.

It is only, however, upon the diseased or debilitated body that Tonics display their effects. If the animal fibre possess its normal cohesiveness, density, and health; if the elements of the blood be in due proportion; and the nerves neither too susceptible nor otherwise; the influence of these medicinal agents is not perceptible; the condition of the body is not altered; in the activity and force of movement, in the various functions of circulation, respiration, secretion and nutrition, no alteration is apparent. Tonics operate on the vital principle through the medium of the nerves; and, so far, they may be regarded as Excitants; but, in effecting this, their operation is gradual; there is no *sudden* alteration of the pulse after their administration: they neither *call forth* nor *repress* arterial action; nor is the energy which they afford to the frame followed by proportional languor or collapse: they operate without any evident phenomena of *immediate excitement* productive of depression, such as follow the administration of *stimulants*; or of *immediate depression*, as produced by *sedatives*: hence they differ essentially from both these groups of medicines. But it is chiefly the *Excitant* and the *Tonic* which are frequently confounded together. From what has been said, however, the distinction is obvious. If a medicine, introduced into, or applied to the living body, be followed by a *sudden* or *high* state of action, and this be as rapidly changed to a state of depression or *collapse*, and

both states be obvious, the substance is an *Excitant*. If, on the contrary, the action be *scarcely perceptible*, and very slowly produced, and no consequent exhaustion nor depression takes place; and if, by continuing the medicine, at intervals not so long as to allow the dissipation of the impression, the body gradually acquires a greater degree of power, and approaches nearer to the condition of health than was the case when the medicine was first administered, and continues so, this is a *Tonic*. The *permanency* probably depends on the reiteration of the *impression* made by the Tonic; and, although, owing to the law of habit, which greatly influences the effects of impulses on the nervous system, the energy of the Tonic is less and less powerfully felt; yet, as there is a correspondent abatement of exhaustion, the acquired energy becomes permanent. It may, nevertheless, be contended, that there is merely a modification of the same action following the administration of both *Excitants* and of *Tonics*: that, if the dose of a stimulant be so reduced, that its influence is scarcely perceived, and if its action be continued by the repetition of the medicine, and, consequently, of the impulse, at short intervals, the ultimate effect will be *Tonic*. There is some truth in this argument; and in a certain diseased state of the body, also that of inflammation, the administration of some Tonics, namely, those metallic salts which operate, in large doses, as acrid poisons, augments both the force and the frequency of the pulse, and produces effects as injurious as those of a direct stimulant nature; yet this does not alter the truth of the distinction; for this is not the case when bark, and those Tonics that possess no poisonous properties, are administered. All that can be yielded to the argument is, that some *Tonics*, as well as *Excitants* and *Sedatives*, prove poisonous in overdoses: but there is a wide difference between the tonic effect of a medicine, administered in small or moderate doses, and its poisonous effect in large doses; the one is a salutary change in vital action, the other is the destruction of vital action. "There is no analogy," as Dr. Billings, reasoning upon this subject, justly remarks, "between the disease which the Tonic cures, and the diseased state produced by the caustic poison."

It may, indeed, with equal propriety, be advanced, as an argument against the explanation of the operation of *Tonics* which I have advanced, that Emetics and Purgatives are Tonics. It is undeniable that relaxation and general weakness may depend on a loaded state of the stomach and bowels, or an accumulation of imperfect secretions in these organs; and that the condition, produced by these causes, may be remedied by the action of an Emetic or a Purgative: but, although the results are equivalent to that of a Tonic—tone being the sequence of all three, yet, assuredly, these medicines *cannot* be regarded as

Tonics. As far as regards the distinction between *Tonics* and *Excitants*, this fact must always be kept in view. The more healthy and vigorous the organs are, the more readily, decidedly, and energetically, *stimulants* act upon them: on the contrary, the more vigorous and healthy the body is, the less susceptible it is of the influence of *Tonics*. This affords an answer to the inquiry which has often been made, namely, to what practical inference does a knowledge of this distinction lead? I reply, that it is of the utmost consequence to be aware, that *Tonics, strictly* so called, are *not* stimulants; that they may be used to give strength and vigour to the system when stimulants would be hurtful; because, in producing strength, Tonics do not call forth action: and that, in diseases which require their aid, their employment need not be prefaced by venæsection nor other depleting means; and that, even when fever or inflammation to a certain extent is present, they may be administered; since *tone* is not action, and *action* is not strength. Their influence on the animal œconomy is exerted only on the tonicity of the organs, on that description of contractility which Bichat has named *insensible*, because its exercise is performed in a manner almost imperceptible, and its development excites no very obvious phenomena. The tissue on which it is exerted merely becomes firmer and denser: it evidently resists pressure more than before; and, in observing the organic action which it performs, it is certain that it has acquired greater force than it previously possessed. Were the distinction between Tonic and Excitant not understood, our efforts to reduce inflammation might be carried to an extent sufficient to destroy life, without the end being effected, were the powers of the constitution not supported by a Tonic. But if, instead of employing a simple Tonic, we employ a medicine which combines stimulant and tonic powers, the deleterious influence of the former may overcome the salutary power of the latter, and a degree of fever be lighted up, which, aiding the inflammation, will certainly terminate in death. On the contrary, Tonics, by imparting strength to the capillaries, operate beneficially in inflammation, even when the use of the lancet is requisite to keep down the action of the heart. If the Tonic be not administered in time, we may in vain attempt to introduce it into the system when the acute stage of the disease is subdued, and the constitution is sinking from debility. In the same manner, Tonics have been confounded with *Astringents:* but the distinction between them will be clearly evinced under the head of Astringents.

Such is the nature of a Tonic, in reference to its action on the animal œconomy in the state of disease: let us now enquire if there is any specific principle inherent in the substances thus employed, which can explain their action, and the manner in which it is extended to the whole of the system.

Some Tonics are of a vegetable origin, others of a mineral; and a few are mental. Almost all of the first group possess, more or less, a bitter quality; and, on this account, bitterness has been regarded as essential to Tonics; and this, in an especial manner, has been attempted to be proved by Dr. Chapman and Dr. Paris. The latter author maintains that extractive is as essential for favouring the digestive function in phytivorous animals, as salt is for favouring that of carnivorous animals: but this accomplished physician has forgotten, in making this remark, that salt is, in one form or another, as essential for the health of *phytivorous* as it is for that of *carnivorous* animals. It must also be recollected, that there are vegetable Tonics that contain little or no bitter extractive, yet possess considerable tonic powers: hence it by no means follows that bitter extractive is essential to all vegetable Tonics; nor is the Nitrate of Silver and several other metallic salts, which impress a bitter taste on the palate, indebted to that bitterness for the tonic power which they display. It certainly is not requisite to regard *bitterness* as an essential principle in Tonics.

It has also been supposed that Extractive, whether bitter or otherwise, is capable of exerting an influence on the diseased system sufficient to restore its tone and energy; and that the same power is due to the alkaloids: hence, that there are several tonic principles; an opinion much more probable than that which would ascribe tone to bitterness: for, assuredly, we cannot suppose any one principle as being alone productive of *strength* or *tone*. The experiments of Dr. Adair Crawford on animals, illustrate this fact in a striking point of view. He exposed portions of the alimentary canal of kittens to solutions or infusions of vegetable substances; and, at the same time, the exposed portions of the skin to the action of the same infusions or decoctions. He found that, when Peruvian bark was employed, or Chamomile flowers, or Gentian, the cohesion of the intestines was increased, and that of the skin diminished. *Calumba*, *Cascarilla*, *Myrrh*, and *Serpentaria*, caused a small increase in the cohesion of the intestine, but so inconsiderable, that it could scarcely be appreciated: their opposite effects on the skin were also very inconsiderable. Most of the salts, usually employed as Tonics, tended to augment the cohesion of all the soft parts of the body. In conclusion, he ascertained that the property of strengthening the intestines, and of weakening the skin, is common to all substances justly celebrated as remedies for intermittents; and that it is remarkable that Peruvian bark possesses the above-mentioned properties in the highest degree. I do not mean, in noticing these experiments of Dr. Crawford, to maintain the opinion, that physical experiments on the animal œconomy afford correct inferences as to the nature of the change which is exerted on living bodies, productive of consequences

closely resembling strength or tone: on the contrary, whilst they serve to illustrate some points, they must be received with caution: whilst they afford force to the remark, that no single principle can be regarded as solely productive of tone, they are not put forward as applicable to any practical purpose. This remark is verified by the fact that Mental agents operate as Tonics; for experience has demonstrated that both *Confidence* and *Hope* are powerful Tonics. With respect to the first of these agents, every practitioner, who has had many years' experience, and has not shut his eyes to the influence of various impressions on the recovery of his patients, knows well the paramount importance of gaining an ascendency over the mind of his patient; and, consequently, of the importance of *Confidence* in the treatment of disease. With respect to the manner in which it operates, we have only to observe the general impulse which the exhilaration of the mind, consequent on Confidence, inspires in the patient; it affords vigour to the heart and arterial system in diffusing blood more equally over the body, throwing it into the capillaries, and thus restoring the general balance of the circulation. Now, with the augmented vigour of the arterial action, the secerning system must necessarily sympathize; and, consequently, every function will be more properly fulfilled: a certain supply of blood to every part of the body being absolutely requisite for the support and continuation of all its functions. Even during hæmorrhages which threaten immediate dissolution, *courage* and *confidence* will sustain the action of the heart, and avert that fatal syncope which would otherwise take place. *Confidence*, in this case, affords a tolerance of the loss of blood, which is only to be attributed to its exerting a tonic power.

In the same manner, *Hope* may operate as a Tonic. Deprive a patient of this solace, even after his disease has been removed, and debility alone remains; there can be no well-founded assurance of his restoration to perfect health: inspire him with the hope that his recovery is certain, and the prognostic will seldom fail to be realized.

> "Is there no hope? the sick man said;
> The silent doctor shook his head;
> And took his leave, with signs of sorrow;
> Despairing of his fee to-morrow*."

And well he might; for nothing is so likely to hasten the fate of a dangerous malady as the doubtful look of the physician. These effects of mental influences depend on the connection of the mind with the body, through the medium of the nerves; and if a tonic influence be the result of nervous energy, when the agents exerting it are material, there is no reason why it should not be referred to the same cause when

* Gay.

they are mental affections. "The soul and the body," says Sterne, "are like a coat and its lining—rumple the one, and you rumple the other." We may reverse the remark: rouse the energy of the mind by Hope, and you lessen the depressing power of the disease.

The action of Tonics varies on the different organs of the body.

1. *On the Digestive Organs.*—When any tonic agent is taken into the *stomach*, if it be a vegetable body, it is partially digested, and the active principle is set free from the inert vegetable matter: if it be an inorganic substance, no digestion of it takes place. In either case, the *tonic*, in the first instance, operates locally on the lining membrane of the stomach, and the muscular fibres beneath it. This process, if the tonic substance be a vegetable product, and is swallowed in a solid form, requires a longer or a shorter time, according to the energy of the *reducing* powers of the stomach. When it is accomplished, and the active ingredient is separated, or if it be not a vegetable body, soon after it is swallowed, the villous coat of the stomach becomes dry, owing to the suspension of the secretions and exhalations which usually moisten its surface. There is next, a contraction of fibres, which cause the coats of the organ to become firmer and more resisting, whilst the capacity of its cavity is lessened. This invigoration of tissue is followed by a sensation of hunger, and an increase of appetite; and the digestion proceeds without consciousness. This augmentation of appetite, and the *absence* of sensation in the stomach during the exercise of the digestive function, is the first obvious evidence of the influence of the Tonic operating as a beneficial therapeutical agent: for when the powers of the stomach have been so weakened that the reducing influence languishes, the digestive process is accompanied with pain and uneasiness. The topical influence of the tonic on the stomach is next extended to the intestines, where its salutary influence becomes equally obvious. If *constipation* existed from the torpidity of the colon and the rectum, the Tonic awakens the vital energy in these parts, and removes it: if *diarrhœa* existed, owing to the deficient action of the lacteals in taking up the fluid parts of the chyme, this is lessened, and the fæces acquire form and consistence.

In very large or over-doses, however, Tonics, instead of allaying uneasy sensations in the alimentary canal, cause them, and irritate the great sympathetic plexus; hence heat, nausea, weight at the stomach, and painful sensations, follow. As the medicinal agent descends into the intestines, it excites inordinate contractions in them, so as to retain the food, in particular portions, in a state that admits of fermentation; causing the

evolution of gas, and the colics that supervene. It is this primary irritant action of Tonics, in large or over-doses, on the mucous membrane, that sometimes produces purging, although the impression is of a distinct nature from that of actual purgatives.

The action of Tonics, in moderate doses, on the stomach and the intestinal canal, is succeeded by a secondary one on the general system. This may be either the consequence of nervous sympathy, or of the absorption of the Tonic into the circulation. I am not aware that any Tonics introduced into the stomach have been detected in the blood, although they have been discovered in the secretions; but the difficulty of detecting them is no argument against the idea of their absorption: the explanation of the effect, on the idea of sympathy, is not more easy. But although we are ignorant of the manner in which the secondary influence of Tonics is produced, yet there can be no doubt that their *primary* action on the alimentary canal is extended to the rest of the system.

Such is the influence of Tonics on the stomach in a weakened or languid condition of the general system, when the organ itself is labouring under no specific disease. When it is diseased, then changes take place very different from those already described. When the organ is in an *irritable* state, whether the irritation be confined to the mucous membrane or extended to the other tunics, Tonics exasperate the evil; the redness and dryness of the tongue, which characterize this diseased state of the stomach, are increased; the thirst is augmented; and the heat usually felt at the epigastrium becomes more vivid. After swallowing the medicine, a sensation of fulness and a painful distention at the gastric region is experienced, anxiety supervenes, and there is a craving for cold, acidulous fluids. If, instead of simple irritation, *inflammation* of the organ exists, then the administration of Tonics become more injurious; pain, great heat in the diaphragmatic region, eructations, sometimes vomiting, follow each dose of the medicine: these symptoms are succeeded by general excitement, heat of skin, acceleration of the pulse, and general fever. This *topical influence* of Tonics, on an inflamed mucous surface, does not stand in opposition to the fact that Tonics cure inflammation. The influence of food on the diseased stomach is not less injurious than that of tonic medicines. It is only when Tonics exert their general influence on the habit, so as to impart energy to the capillaries, that they have a beneficial effect on inflammation. In this condition of the mucous membrane, their action is limited to the diseased surface. If *ulceration* exist, the effects of Tonics are much modified by the situation of the ulcers: if these be confined to the cardiac portion of the organ, the deleterious influence of the medicinal agent is much less obvious than when they cover the

pyloric portion; or when they are seated in the great curvature. In these cases, the tonic impression is followed by heat, severe lancinating pains, and other sensations which indicate acrimony.

It often happens that the *stomach*, the *intestines*, and the *liver*, suffer from a morbid susceptibility of impression which does not depend on any affection of the tissues, but originates in an irritation of the cerebro-spinal centres, or the great sympathetic plexus. These organs, also, may be in a state of languor or torpor, proceeding from an opposite cause, a deficiency of nervous energy, from a morbid condition of the brain and the spinal marrow, and the whole ganglionic system. In this state of the nervous energy, the whole of the organic tissues lose their susceptibility to impressions of every kind; and their aptitude to movement; and they suffer a depression in their functions without any change in their normal state. Again, when the organ is in a state of hypertrophy, tonic medicines augment the already inordinate appetite of the patient; and accelerate the return of the sensation of hunger, which is always imperious in this condition of the stomach.

2.—On the *circulating system.* Tonics operate on the heart and arteries in two ways. 1. They act upon the heart through its sympathy with the stomach. 2. They act directly upon the heart, by the absorption of the tonic substance, or some part of it, and augment its muscular energy. After the administration of the full dose of a Tonic, the pulse becomes fuller and firmer; but its beats are *not* quicker, the current of the blood is not accelerated: the Tonic *strengthens* the moving organs without *precipitating* their action.

This influence of Tonics on the circulating system is extended to the *capillaries.* If imprudently administered to young people, or to those of a sanguine temperament, or of an irritable constitution, they favour sanguineous congestions, hæmorrhagic efforts, and even cause inflammation. These effects, however, are not produced in the same manner as when excitants are administered: it is, indeed, the distinct influence of Tonics and Excitants on the circulation, and the calorification of the body, which demonstrate the difference in the character of their medicinal powers. When the heart is suffering under *dilatation*, the employment of Tonics often diminishes progressively the enlargement of the ventricular cavities, and restores them to a normal state; a fact of great practical importance. When actual *hypertrophy* is present, although the augmentation of arterial action might be anticipated, this is seldom the case: but if the left ventricle be the seat of the disease, the head suffers; vertigo, singing in the ears, and other symptoms resembling those which follow the use of excitants in the same disease, present themselves.

3.—*On the Respiratory Organs.*—In a healthy condition of the *lungs*, no obvious effect is displayed on the respiratory function by the administration of Tonics: but in pulmonary diseases their influence is rapidly made conspicuous. In an irritable condition of the bronchial tubes, they excite coughing, cause a sensation of heat in the chest, and a feeling of anxiety. In inflammation of the substance of the lungs, or their involving membrane, the intensity of the diseased state is augmented, the cough rendered more urgent, and the expectoration suppressed: but when the inflammatory action is subdued, and the lungs are suffering from previous severe disease, then Tonics lessen the force and the frequency of the cough, and promote expectoration. It must, however, be recollected that when tubercles are in an active state, Tonics augment all the symptoms that accompany their presence, and threaten the destruction of life.

4.—*Upon the Secerning System.*—Tonics augment the strength, but do not increase the secreting power of the glands: their action remains the same as in health. They increase the energy of the cutaneous capillaries; and, consequently, they are indicated in cases of great debility, accompanied with profuse sweating. On the urinary organs, when these are in a healthy condition, they display no obvious influence; but, in disease, they invigorate the kidneys, and secure the performance of their ordinary action. In a leucophlegmatic condition of these organs, they enter the circulation, augment the vitality of the kidneys, and increase the urinary discharge: but if these glands are in an irritable condition, they add to the mischief.

5.—*Upon the Nervous System.*—From what has been already said, the influence of this class of medicines upon the nerves may be readily understood. It is, therefore, unnecessary to enter more particularly into this part of our enquiry.

The effects of Tonics upon the system generally are seldom rapidly apparent; but, after they have been taken for some time, their influence becomes obvious, by the increased force of the circulation, the augmented power of the digestive organs, the improvement in the secretions, the abatement of nervous susceptibility, and the increased energy, in particular, which is communicated to the muscular system. A Tonic, when it operates favorably, places the system in that state which characterizes health; and, from the mode by which this effect is produced, the character of the diseases in which Tonics are indicated is sufficiently obvious: they are those of depressed power. But the chief use of Tonics, as medicinal agents, is in convalescence, when the habit has been left weak and relaxed after the attacks of acute diseases. In this state, the gentlest Tonics, in combination with aromatics, are to be preferred.

From the remarks which have been made, it is obvious that *Tonics* are distinct from *Excitants;* but that, at the same time,

they may be regarded as operating to a certain extent as *Excitants.* But as the degree of excitement which they induce, is greater or less, they may be classed under two heads, namely—

1. *Sub-excitant Tonics;*
2. *Excitant Tonics.*

TABLE OF TONICS.

A. SUB-EXCITANT TONICS.

1. *Operating chiefly on the Stomach.*

* *Organic Products.*

a. Cinchonia—

combined with Kinic Acid, in

Bark of Cinchona *Condaminea.*	5. 2.	Cinchonaceæ.
——— *micrantha.*	– –	———
* ——— *lucumæfolia.*	– –	———

combined with Acids, in

Sulphate of Cinchonia:
Hydrochlorate of Cinchonia:
Acetate of Cinchonia.

b. Quina—

combined with Kinic Acid, in

Bark of Cinchonæ *variæ.*	5. 2.	Cinchonaceæ.
* ——— *lanceolata.*	– –	———
* ——— *hirsuta.*	– –	———
* ——— *nitida.*	– –	———
* ——— *magnifolia.*	– –	———
* ——— *purpurea.*	– –	———

combined with Acids, in

Disulphate of Quina:
Hydrochlorate of Quina:
Acetate of Quina.

c. Piperina.

d. Gentiania—contained in

Roots of Gentiana *lutea*	5. 1.	Gentianaceæ.
* ——— *Catesbæi.*	– –	———
* ——— *Amarella.*	– –	———
* ——— *Kurroo.*	– –	———
Herb of Agathotes *Chirayta.*	– –	———

e.	SALICINA—contained in			
	Bark of Salix *fragilis.*	22.	2.	Salicinaceæ.
	—— *Caprea.*	—	-	——
	—— *alba.*	—	-	——
	—— *Russelliana.*	—	-	——
	* —— *purpurea.*	—	-	——
	* Populus *nigra.*	—	-	——
f.	QUASSINA—contained in			
	Wood of * Quassia *amara.*	10.	1.	Simarubaceæ.
	Picræna *excelsa.*	—	-	——
	Roots of Simaruba *amara.*	—	-	——
	Herb of Erythræa *centaurium.*	5.	1.	Gentianaceæ.
g.	BITTER EXTRACTIVE—contained in			
	Roots of Cocculus *palmatus.*	20.	6.	Menispermaceæ.
	* —— *Fibraurea.*	—	-	——
	* —— *cinerascens.*	—	-	——
	* —— *Crispus.*	—	-	——
	Rhizome of Geum *urbanum.*	12.	5.	Rosaceæ.
	Plant of * Apocymum *andro-semifolium.*	5.	2.	Apocynanceæ.
	Cetraria *Islandica.*	24.	3.	Lichenes.
	* Sabbatia *angularis.*	5.	1.	Gentianaceæ.

* * *Inorganic Products.*

h. METALLIC SALTS.

i. IODIDES.

Iodide of Zinc.

k. CHLORIDES.

Chloride of Barium.

l. OXIDES.

Oxide of Zinc.

m. SALTS.

Sulphate of Zinc.
Acetate of Zinc.
Sulphate of Copper.
Ærugo.
Acetate of Copper.
Trisnitrate of Bismuth.

2. *Operating through the medium of the Blood.*

* *Organic Products.*

Leaves of Menyanthes *trifoliata.*	5.	1.	Gentianaceæ.
Arctostaphylos *Uvæ Ursi.*	10.	1.	Ericaceæ.
Flowers of Cnicus *benedictus.*	19.	3.	Compositæ.

* * *Inorganic Substances.*

a. IODIDES OF METALS.
Iodide of Iron.

b. OXIDES OF METALS.
Lime.
Black Oxide of Iron.
Sesqui Oxide of Iron.

c. METALLIC SALTS (*Oxides and Acids).*
Nitrate of Silver.
Carbonate of Iron.
Acetate of Iron.
Tartrate of Iron and Potassa.
Citrate of Iron.
Sulphate of Iron.
Tincture of Hydrochlorate of Iron.

d. ACIDS.
Sulphuric Acid.
Nitric Acid.
Phosphoric Acid.
Hydrochloric Acid.
Arsenious Acid.

e. CHLORIDES.
Chloride of Sodium.
——— of Calcium.

f. ARSENITES.
Solution of Arsenite of Potassa.

B. EXCITANT TONICS.

Operating through the medium of the Nerves.

PONDERABLE.

* *Organic.*

a. PEPPERS.

Fruit of Piper *Nigrum.*	2. 3.	Piperaceæ.
—— *Longum.*	– –	————

b. COFFEE.

Fruit of Coffeæ Arabicæ.	5. 2.	Cinchonaceæ.

c. BITTER EXTRACTIVE with OLEO-RESIN, in

Flowers of Anthemis *nobilis.*	19. 2.	Asteraceæ.
Bark of Croton *Eleutheria.*	21. 8.	Euphorbiaceæ.
Protium *Kataf.*	6. 1.	Burseraceæ.
Rizhome of Acorus *calamus.*	– –	Acoraceæ.

IMPONDERABLE.

d. Cold Bathing.
e. Friction.
f. Exercise.
g. Travelling.

* *Mental Influences.*

h. Hope.
i. Confidence.
k. Amusements.

SUBEXCITANT TONICS.

1. *Operating chiefly on the Stomach.*

* *Organic Products.*

a. Cinchonia.—This is an alkaline salt, which is contained in the Cinchona barks, in combination with Kinic acid When obtained in a separate state, it is a crystalline salt, white, transparent, in needleform quadrilateral crystals, with oblique terminal facets. When pure, it is inodorous, and feebly bitter to the taste, nearly insoluble in cold water, and requiring 2500 times its weight of boiling water for solution. It is slightly soluble in cold, and very soluble in boiling alcohol; and slightly in ether and in fixed and volatile oils. It crystallizes readily, as the hot alcoholic solution cools. It is unalterable in the air; displays an alkaline reaction with the blue of vegetable colours reddened by acids; and unites with many acids, forming neutral salts. When submitted to a high temperature, it is first fused, and then decomposed, affording the usual products of azotized substances: its ultimate components are—

	Pelletier and Dumas.	Brandes.	Henry and Plisson.	Liebeg.
Carbon	76.97	79.90	78.88	77.88
Nitrogen	9.02	13.72	9.35	8.87
Hydrogen	6.22	7.17	8.87	7.37
Oxygen	7.79	0.00	2.89	5.93

or of 1 atom of Quinogen ($C^{\cdot 20}$, $H^{\cdot 12}$, $N^{\cdot 0}$) + 1 Oxygen— equiv. 156.61.

Owing to the spare solubility of Cinchonia, it has little taste, and exerts slowly its action on the animal system: but, in combination with acids, its bitterness is considerable, and it forms a very valuable Tonic. It is procured by various processes; but the following is the most productive—one pound of powdered Pale Bark is boiled in a gallon of water, acidulated with f℥ii of sulphuric acid, and the residue re-boiled in fresh portions of

acidulated water until it cease to yield any thing to the fluid. These decoctions are next to be evaporated and mixed with milk of newly slacked lime, in slight excess; which, forming an insoluble salt with the acid, carries down with it the Cinchonia. This sulphate of Lime and Cinchonia is then to be squeezed in a cloth and dried, and treated with boiling rectified spirit, which takes up the Cinchonia; and, by distilling off three-fourths of the spirit, the salt is obtained in the crystalline form*. The quantity of Cinchonia, obtained from a given weight of Pale Bark, is so differently stated by different experimentalists, that no correct idea can be formed respecting it. According to Von Santen, Crown Bark contains no Cinchonia; fine quills of Grey Bark, 24·33; medium quills, 27·3 parts in 1000 parts: according to Soubeiran, Crown Bark of a fine quality yielded 12·3, Grey Bark 9·2; Goebel, from fine Crown Bark, obtained 2·6 of Cinchonia, and 2 of Quina; from Grey Bark, 21·3 of Cinchonia*.

Cinchonia is the chief active principle in the pale officinal Cinchona Bark, in which it is combined with *Kinic acid*, forming a kinate.

Kinic or *Cinchonic Acid* is seldom procured in crystals: it has an acid taste, and reddens the tincture of litmus. Its crystals, when obtained, are unalterable in the air, soluble in water, from which it is not precipitated by chloride of calcium, nitrate of silver, and acetate of lead; but it is thrown down by the diacetate of lead; and, when heated, it is partially decomposed and converted into a distinct acid, the Pyrokinic, which is characterized by precipitating persalts of iron of a beautiful green colour; and, also, precipitating the salts of silver and of lead. Kinic acid is procured by evaporating the infusion of Pale Cinchona Bark, and treating the residue with alcohol: a viscid matter is left, consisting of Kinate of lime and mucilage. Dissolving this in water, the Kinate crystallizes; and, by decomposing it with Oxalic acid, the Kinic acid is set free, and may be crystallized. This acid forms kinates with salifiable bases. It possesses no medicinal properties. Its components are, C·15, H·9, O·9, equiv. 170·80†.

Cinchonia, when separated from the Kinic acid and combined with sulphuric, or hydrochloric, or acetic acids, forms very soluble salts.

Cinchonia is procured in greatest quantity from the Grey or Huanuco Bark and the Red Bark; and in small quantity only from Crown Bark. It is contained in the Bark in the form of a kinate. It might be supposed that this salt would be the best substitute for the Bark itself. This conclusion, however, is

* This process of M. Henry's is expensive, on account of the waste of spirit.

† Christison's Dispensatory, p. 329.

‡ Liebig.

more specious, probably, than true: for the artificial combinations of the active principles of vegetable bodies frequently produce more useful compounds than the natural. The kinate, however, may be separated in the following manner: evaporate a strong decoction of Pale Bark to the consistence of a syrup; then pour upon it three times the quantity of cold distilled water originally used, and separate the deposite. Evaporate the liquid to one half, and saturate the excess of kinic acid with carbonate of lime; then add newly prepared hydrate of oxide of lead; and, when the whole has become of a clear yellow colour and neutral, filter. Pass through the filtered liquor a stream of sulphuretted hydrogen; and, having again filtered, evaporate to the consistence of a syrup: treat this with alcohol at 815°, which throws down the kinate of lime and gum, and also a certain quantity of the kinate of Cinchonia. Solution in water and evaporation afford the salt in the crystalline state. This kinate is soluble in water, but scarcely in alcohol at 815°; it is very bitter, and is decomposed by ammonia and lime water. An artificial kinate may be prepared by combining the Cinchonia already prepared with Kinic acid: a clear, very bitter, scarcely acid solution is obtained, which, when evaporated in a water bath, furnishes an amber-coloured mass, or, if slowly crystallized, bright papillary crystals.

The barks that yield Cinchonia are the *pale*, or Crown Bark of Loxa; and *red* bark of commerce.

1. Pale Cinchona Bark. *Cinchonæ Lancifoliæ Cortex.* L. D. *Cinchona Coronæ*. E.—This Bark and the tree yielding it, having been described by Condamine, in 1738, was that first brought to Europe; it has been named Cinchona *Condaminea* by Humboldt and Bonpland. The Bark is called Loxa or Crown Bark, in commerce*.

The genus Cinchona belongs to the natural order Cinchonaceæ. It is a very extensive genus, but, as yet, little known. The greater number of species are natives of South America, particularly of Peru, and to the west of the Andes†.

The Cinchonas are found chiefly in Peru, growing on micaceous schists, at heights of from 5,700 to 8,300 feet, at a mean temperature between 59° and 62° Faht. Their localities are the mountains of Cajanuma-Uritucinga near Loxa; those of Boqueron Villonaco and Monje; and also near Guancabamba and Ayavaca. Cinchona *Condaminia* is a lofty, handsome *evergreen* tree, rising from 30 to 40 feet high, and seldom found in groups. The twigs are smooth; the leaves also smooth, usually ovato-lanceolate, thin, and having at the axils of the veins a pit, naked

* Cascarilla fina de Uritusinga of the Spaniards.

† Humboldt, Plant. Æquin. 1, p. 33, t. 10. Richard, Hist. Nat Med. t. ii, p. 295. Lindley, 414. Hayne, vii, 37. The tree named by the London and the Dublin Colleges, yields the orange bark of Santa-Fee, not the officinal Pale Bark.

or ciliated, and supported on petioles one-fourth of their length. The stipules, which are interpetiolar, are oblong, obtuse, membranous, and smooth. The flowers are in corymbose panicles, in the axils of the upper leaves, forming a large loose thyrse.

Like other Cinchonas, this species is barked in September; and the bark is known to be in a proper state when, on raising a portion of it, the air gives it a reddish colour.

Although this tree yields the original Pale Bark, yet there is no doubt that the name, Pale-bark, comprehends the bark of several distinct species. Thus, the C. *micrantha* yields the GREY BARK or HUANUCO; the ASH BARK is supposed to be the production of Cinchona *cinerea*, E. and the C. *ovata;* but both it and the White Loxa Bark, sometimes brought in the serons of Pale Bark, are justly regarded by Professor Lindley as the barks of unknown species. Pale Bark is imported in serons and chests, containing from sixty to one hundred pounds.

Crown Bark is generally in small tubes or quills, single or double, from six to twelve or sixteen inches long, and varying in diameter from a fourth of an inch to two-eighths of an inch, and in thickness from one-twentieth to one-sixth of an inch; covered with a rough, entire epidermis, cracked both longitudinally and transversely: the colour varies from grey to brown; and it is thickly beset with lichens, sometimes stringy; on which account it is called, in Peru, *Quinicani*, or hairy Quina. The lichens mark the quality of the bark—thus, those barks bearing *Collemata*, *Parmelia*, and *Jungermania*, are bad: those bearing *Graphides*, *Opegraphæ*, or *Lecanoræ*, are good. The size of the quills is regulated by the age of the branch, which affords a more quilled bark the younger it is: but the collectors often quill it by heat. Internally, the colour is of a pallid fawn, or cinnamon brown hue, which brightens to pale orange-brown when the bark is moistened. The smaller specimens break with a clean fracture, the larger with a fibrous. The quilled bark comes from Loxa; but some, which is not quilled, from Huanuco. On account of the quantity of lichens on this bark, the first powder should be rejected; or the lichens scraped off before powdering the bark.

Pale Bark, besides being known in commerce by the name *Crown Bark*, is called Calysaya, with an epithet descriptive of its form: thus, Quilled Bark is called *Calysaya* arollada in cauntillos; flat, *Calysaya* de plancha; and so on. It is also known by the name *Cascarillo fina de Loxa.* There are four distinct varieties of Pale Bark.

1. The first is the *Quilled Bark of Loxa*, Calysaya ahumada de Loxa, Cascarilla de Loxa, in single and double quills, thin and light, in pieces of from twelve to eighteen inches long. Its epidermis is brown, or iron-grey, covered, when good, with *Graphides.* The taste is astringent and bitter, the odour weak.

2. The *Grey Bark of Loxa* is supposed by Dr. Pereira to be the bark of the Cinchona *ovata* of Ruiz and Pavon. It occurs in curved quills. Its epidermis is smoother than the former variety, and covered with a coating of whitish lichens, whence the name. It is thinner than the preceding; indeed, almost as thin as Cinnamon bark. Its taste is feebly astringent and bitter, with a faint aromatic odour. In Peru, it receives the name of Lagartijada, Lizard-like, and Negrillo, Blackish, from the colour of its epidermis.

3. The *Bark of Lima*, of commerce, is the *Grey Bark of Huanuco, Cascarilla provinci*, and *C. fina;* the *C. cinerea* E. probably that of the *C. micrantha** of Ruiz and Pavon†: it is in thicker and coarser pieces than the Crown Loxa Bark, the quills being sometimes about an inch in diameter, occasionally two inches, with oblique edges; the epidermis thin, easily separated, cracked with partial transverse fissures, and covered with crustaceous lichens‡. Its fracture is compact and resinous; its colour, internally, rusty-brown; has scarcely any odour; and tastes astringent, bitter, and aromatic. One pound of this bark, according to Van Santen, yields from 71 to 210 grains of Cinchonia; according to Goebel, 168 grains of Cinchonia: but other chemists state that it yields Quina as well as Cinchonia. This discrepancy probably arises from the bark not being exactly the same.

4. To these varieties may be added Ash Cinchona, *Cascarilla pallido*, the bark of *C. ovata*. It is in quills, varying from half an inch to one inch in diameter; and from half to two lines in thickness. The quills are curved and somewhat twisted: the epidermis, not much cracked, of an ash-grey or whitish-grey, with blackish spots; internally, of a cinnamon hue; and the fracture splintery. The odour is that of tan; the taste bitter and astringent. It contains, according to Michaelis and Goebel, more Quina than Cinchonia. It is chiefly used for mixing Crown Bark.

The knowledge of these varieties is of little moment: it is sufficient, for the purposes of medicine, to distinguish the Lima and the Loxa Bark.

In tracing the chemical history of this species of Cinchona Bark, it is unnecessary to offer any account of the early analyses. Dr. Duncan of Edinburgh, in 1803, finding that the decoction was precipitated by infusion of galls, first hinted the existence of a new principle, and named it *Cinchonin*. Gomez (Memoirs of

* C. *scrobiculata*, Humb. and Bonpl.

† Quinolog. suppl. p. 1, De Cand. Pridr. iv, p. 354. Lindley, 412.

‡ These, according to Fee (Cryptog. 1824) are Opegraphæ, Graphides, Arthoniæ, Pyrenulæ, Ascidium *Cinchonarum* and Lecidea *tuberculosa*. Neither mosses nor jungermanias are found in it.

the Lisbon Academy), in 1810, examined the Cinchonia of Duncan, which he procured in small, white, acicular crystals. His process was to dissolve an alcoholic extract of Cinchona Bark in water, and then to treat it with potassa, which dissolved successively all the extractive, and left the Cinchonia undissolved. This was afterwards dissolved in alcohol and crystallized by evaporation. The alkaline character of the salt was first pointed out by Pelletier and Caventou, in 1820, who found, also, that Pale Bark yields a certain portion of another alkali, which they named Quina. They discovered, also, that these alkalies were combined with a peculiar acid, the *kinic*, in the bark; that it contains, besides, two colouring principles, red and yellow Cinchonic, a trace of volatile oil, a green concrete oil, starch, gum, sulphate of lime, and lignin*.

Good Pale Bark, although it has scarcely any odour, in substance, gives out an agreeable aromatic odour in decoction, depending on a volatile oil, which Dr. Irving procured in a distinct state. The infusion and decoction are agreeably bitter, slightly acidulous and austere: both are of a pale, brownish-yellow colour: they redden litmus paper and precipitate infusion of galls; the tannic acid of the galls forming an insoluble tannate of Cinchonia by decomposing the kinate. Both render a solution of tartar emetic turbid and inert; yet, the solution of pure Cinchonia does not precipitate it. The sulphate of iron produces a slight precipitate, of an olive-green colour, and acetates of lead, white; evidently depending on the formation of tanno-kinates, whilst the acids unite with the Cinchonia, forming a soluble salt. The alkalies, ammonia, and their carbonates, and lime water, also precipitate the infusion and decoction of Pale Bark, throwing down the alkaloids; whilst the solution of Bichloride of Mercury forms with them insoluble double salts. Precipitates are also formed by solutions of Opium, the hydrochlorate, the acetate, and the sulphate of Morphia. The aqueous infusions of many bitter and astringent vegetables, as of Oak bark, Chamomile flowers, Calumba root, Cascarilla bark, Horse raddish, Cloves, Orange peel, Foxglove, Rhubarb, Valerian, Simaruba bark, Elm bark; and solutions of Kino and Catechu precipitate the infusion and decoction of Pale Cinchona Bark. The tincture of this bark suffers similar decomposition from these reagents; but the colour struck in the tincture with sulphate of iron, is deeper and blacker than that in the infusion and decoction. Chloride of Barium produces no change either in the decoction or in the tincture; both the hydrochlorate of Cinchonia and the kinate of Baryta, which are formed, being soluble: hence, this salt may be administered in combination with these preparations. The quantity of the precipitate formed

* Voreton, Ann. de Chim. et de Phys. t. xvii.

with the infusion of gall-nuts, demonstrates the goodness of the bark*; for, according to the quantity of Cinchonia which it contains, the tannate will be more or less abundant. Many of the other precipitates may occur, although no Cinchonia be present in the infusion or decoction.

Dufles suggested the Chloride of Platinum as a test, the double salts which it forms with the alkaloids being nearly insoluble in cold water and in alcohol. One grain of the double salt, dried in the air, indicates half a grain of the alkaloids†.

When cold water is poured into a strong decoction of pale Cinchona bark, the red insoluble colouring matter, *Red Cinchonic*, is copiously precipitated. When this is dried and pulverized, it is of a dull red colour, and its bitterness is slowly perceived on the palate: it is a compound of modified tannic acid and apotheme. It is this which decomposes the solution of Tartar emetic, when it is added to infusion or decoction of Bark.

The pharmaceutical preparations of the Pale Bark are—Powder, Infusion, Decoction, Tincture, and Extract; besides the salts of Cinchonia.

POWDER OF BARK, *Pulvis Cinchonæ*, was formerly much employed; but it is now seldom prescribed, on account of its bulk and its nauseating taste. The dose, as a Tonic, is gr. x to ʒss, three times a day; as an antiperiodic, ʒi to ʒii, or more, every second hour. It may be administered in water, milk, or wine; the second covers the taste of it most effectually, if the dose be taken the moment it is mixed.

INFUSION OF PALE CINCHONA, *Infusum Cinchonæ*. L. E. D. —The London and Edinburgh Colleges order ℥i of the bruised bark to be macerated in a pint of boiling distilled water, in a covered vessel, for six (four, E.) hours, and strained. The Dublin College orders the bark to be triturated with f℥xii of cold water, macerated for twenty-four hours, shaking now and then, and decanting off the clear liquor. It is a very light preparation, and contains little of the alkaloids. The dose is f℥i to f℥iv.

DECOCTION OF PALE CINCHONA, *Decoctum Cinchonæ lancifoliæ*, L. is made by boiling ʒx of bruised pale bark in a pint of distilled water, for ten minutes, in a covered vessel, and strained. *Decoctum Cinchonæ*, E. D. is made with ℥i of the bark and f℥xxiv (a sufficiency, D.). The Edinburgh College orders the boiling to be ten minutes; and the decoction, when cool, to be filtered and evaporated to f℥xvi; the Dublin to boil it down to one pound by measure. The dose is f℥i to f℥iii. Boiling water takes up the kinates and all the soluble part of the bark, yet, as the decoction cools, the red Cinchonic, and the starch as a tannate, are deposited. They should always be made with water acidulated with diluted sulphuric acid, in order

* Journ. de Pharm. xx, p. 429. † Pharm. Centr. Blatt. für 1831, § 537.

to change the kinate of Cinchonia to a sulphate, which is more soluble than the kinate.

The evaporation of the decoction forms the watery extract, in which the kinate of Cinchonia is combined with all the other components of the Bark, except the woody fibre.

EXTRACT OF PALE BARK, *Extractum Cinchonæ lancifoliæ.* L. D.—The London College orders the evaporation, to a due consistence, of a decoction of ℥xv of the Bark, boiled four times successively in a fresh gallon of distilled water, and strained while hot: the Dublin orders ℥xii to be boiled three times in lb.vi of distilled water for fifteen minutes, and then evaporated. *Extractum Cinchonæ*, E. is prepared by passing f℥xxiv of proof spirit through ℥iv of fine powder of the bark, in a percolater, then distilling off the greater part of the spirit, and evaporating the residue to a due consistence. The last is the most active of these Extracts, as not only the kinates, but the red cinchonic, are taken up by the spirit. They are administered in the form of pills, in doses of gr. v to ss.

There are two tinctures of Pale Bark ordered in the British Pharmacopœias:—

1. TINCTURE OF CINCHONA, *Tinctura Cinchonæ.* E. D.—The Edinburgh College orders ℥viii of the Bark, in fine powder, to be treated with Oii of proof-spirit in the percolater: the Dublin, ℥iv in f℥xxxii by maceration. These are simple spirituous solutions of the kinate of Cinchonia, the red and yellow cinchonics and tannic acid, whether they be prepared by maceration or percolation; but the latter exhausts the Bark more completely. These tinctures suffer the same decomposition from reagents as the Infusion or Decoction. The dose is fʒi to fʒii.

2. COMPOUND TINCTURE OF CINCHONA, *Tinctura Cinchonæ composita*, L. prepared with ℥iv of the Bark and Oii of proof spirit; but containing also the volatile oils and bitter principles of Orange peel, Serpentaria and Saffron. It is known by the name of Huxham's Tincture, and is more stimulant and stomachic than the simple tincture.

The Salts of Cinchonia are not in the British Pharmacopœias; but the Disulphate is frequently employed instead of the Disulphate of Quina; and a Hydrochlorate, a Phosphate, and an Acetate are used on the Continent.

The *Disulphate of Cinchonia* is readily formed by the direct union of the acid and pure Cinchonia. It crystallizes in short oblique prisms, sometimes single and irregular, sometimes double, terminated with dihedral summits. It is soluble in 6½ parts of alcohol, of sp. gr. 817°, and 11½ parts of absolute alcohol: it requires 54 parts of water at 60° for its solution*. By adding

* The greater solubility of Disulphate of Cinchonia enables it to be separated from Disulphate of Quina, by dissolving the mixed salt in boiling water. As the solution cools, the salt of Cinchonia remains dissolved after that of Quina has crystallized.

sulphuric acid to a solution of this sulphate and evaporating, a neutral sulphate is obtained, colourless, permanent in the air, in octohedral rhomboids, soluble in half their weight of water, and in their own weight of alcohol at 817°. The composition of the Disulphate is

		Equiv.	Per Cent.
Cinchonia . .	2 =	313.22	80.201
Sulphuric Acid	1 =	40.1	10.412
Water . . .	4 =	36.0	9.338
Equiv. . .		389.32	100.000

The *Sulphate of Cinchonia* is readily formed by the direct union of the acid and pure Cinchonia. It crystallizes in short, truncated prisms, sometimes single and irregular, sometimes double. This salt is soluble in 6½ parts of alcohol, of sp. gr. 817°, and 11½ parts of absolute alcohol: it requires 54 parts of water at 65° for its solution. By adding sulphuric acid to a solution of this sulphate and evaporating, a bisulphate is obtained, colourless, permanent in common air, in octohedral rhomboids, soluble in half their weight of water, and in their own weight of alcohol at 817°. The composition of the neutral sulphate is:

	Dry.	Crystallized.
Cinchonia . .	88.636 .	. 84.324
Sulphuric Acid	11.364 .	. 10.811
Water . . .	— — .	. 4.865
	100.000 .	. 100.000

That of the bisulphate:

Cinchonia . .	79.592 .	. 67.241
Sulphuric Acid	20.408 .	. 17.241
Water . . .	— — .	. 15.518
	100.000	100.000

The Sulphates of Cinchonia have been little used, owing to the superior power of the sulphate of quina, formed from an alkali found in Yellow Bark. The cold solutions of sulphates of Cinchonia are decomposed and precipitated by infusion of galls, and all astringent vegetable infusions.

The dose is from gr. i to gr. ii as a Tonic; and from gr. ii to ℈i as an anti-periodic.

The other salts of Cinchonia are also made by the direct union of their components. The *Hydrochlorate* crystallizes in acicular crystals; the *Phosphate* scarcely crystallizes, and has a gummy aspect; the *Acetate* is obtained in small granular crystals, which are very soluble.

Quina, L.—This salt was first procured by MM. Pelletier and Caventou, in 1820. It is a white, friable, amorphous salt, which, if exposed to heat of 300°, fuses, and, on cooling, assumes the

appearance of a yellow resinous-like substance. It is inodorous, more bitter than Cinchonia; is scarcely soluble in water at 60°, requiring 2000 parts for one part; 200 parts at 212°. Its aqueous solution, when treated with Chlorine and afterwards with Ammonia, becomes emerald green. Quina, as precipitated from water, is a hydrate. It is soluble in alcohol and ether; and, in conjunction with acids, furnishes salts: the best known of which are the sulphates. Its easy solution in ether distinguishes it from Cinchonia, and separates it from that alkaloid. Its solutions are precipitated by Tincture of Galls and by Ammonia. The composition of Quina is—

	Liebeg.	Pelletier and Dumas.
Carbon	74.40	75.02
Oxygen	9.88	10.43
Hydrogen	7.61	6.66
Nitrogen	8.11	8.45
	100.00	

or 20 Carbon, + 12 Hydrogen, + 11 Nitrogen, + 2 Oxygen; equiv. 164.55.

Quina is procured from Yellow Bark in the same manner as Cinchonia from Pale Bark: or by decomposing disulphate of Quina with Ammonia.

Quina is more rarely seen in the crystalline form than Cinchonia:—this, its intense bitterness, and is solubility in ether, distinguish it from that salt. It is used chiefly for making the disulphate and its other salts. The Bark which yields it is the Yellow Bark of commerce.

YELLOW CINCHONA BARK. *Cinchona Cordifolia.* L. D. *Cinchona flava.* E.—The Edinburgh College has acted judiciously in not referring it to any particular species of Cinchona. This is the Cascarilla Calysaya or Colli-salla of the Spaniards*; but the species of Cinchona which yields it is still unknown. The reference of it to C. *Cordifolia* of Mutis and Zea is incorrect; the bark of that tree being the hard Carthagena bark, a very inferior bark to the true Calysaya. From a leaf which Guibourt found in a specimen of the bark, it has been referred by him to C. *lanceolata;* an opinion previously suggested by Ruiz†, and which is taken up by Dr. Linley‡. It is supposed, with some probability, to be the yellow bark described by Arrot in 1737§. It is the produce of La Paz, in Bolivia.

Yellow Bark is imported in serons, weighing from 125 to 135 lbs. It consists of quilled and flat pieces; the former are from half an inch to two inches in diameter: thicker than those of the Pale Bark, more woody and fibrous: the flat pieces are generally devoid of epidermis; the quilled have a tawny, greyish-brown

* Poppig. † Fl. Peruv. ii. p. 51. ‡ Flora Med. 417. § Phil. Trans. vol. xi, 1837.

cuticle, transversely marked with numerous cracks, which give a rough character to the bark. The cuticle is sometimes, but rarely, covered with flat and stringy lichens, the thallus of some of which is so thickly extended over the Bark as almost completely to obscure the natural surface. There are two distinct varieties of Yellow Bark known in commerce. The *first* is in pieces of various sizes, from that of the finger to two or three inches in breadth. The smaller pieces have a thin epidermis, are very rugged, transversely cracked, and covered thickly with parasitic lichens*. This Bark is of a yellow-fawn colour interiorly, very fibrous in the fracture, and possessing little astringency. The larger pieces have a thicker, rougher, and more deeply cracked epidermis; and, from age, the epidermis consists of various layers; but it is easily detached from the Bark, and is perfectly inert. The Bark is about two lines in thickness, of a deep fawn colour, and a texture entirely fibrous, but fine and uniform. The fibres are studded with brilliant points, the extremities of fibrils, which are detached with ease; they feel harsh between the teeth, and run into the fingers, occasioning itching. On breaking the Bark, a fine yellow fibrous powder falls out. It tastes very bitter and astringent. The *second* variety is known in commerce by the name Hard Orange Yellow Bark: it is less thick, more compact and finer. This is the Bark of the Cinchona *Cordifolia* of Mutis, and the produce of Bogota, Santa Fe; but it is not the yellow bark of commerce. It occurs both in quills and in flat pieces. In the younger specimens, the internal part is of a pure yellow, the external of a rose colour: but this disappears in the old bark. The mixture of these two colours produces a tint which distinguishes this bark from every other. The flat pieces are a little convex, and entirely devoid of epidermis.

Both varieties of the Yellow Bark have more bitterness, but less astringency, than the Pale Bark. They are more pulverulent, and the powder is of a brighter colour than that of the Pale Bark. The aqueous infusion and decoction deposite, on cooling, a sediment, which is of a brighter colour than the dry powder. The Infusion is less turbid than that of the Pale Bark: it reddens litmus paper, and precipitates infusion of galls more slowly than the Infusion of the Pale Bark. Gelatin forms a pinkish-yellow precipitate; Potassio-tartrate of antimony, a yellowish-white and very copious precipitate; and the persulphate of iron throws down slowly a bluish-green precipitate. The other reagents which affect the Pale Bark act upon the Yellow.

* These lichens are Opegraphæ, Arthonia, Fissurina, Chiodecton, Trypethelia, Pyrenula, Porina, Ascidiun *Cinchonarum*, Lepra *flava*, Variolaria *amara*, Lecidea, Parmelia, Sticta; besides some Fungi, Hepaticæ, and Hypnum *Langsdorfii*.

Yellow Bark owes its tonic properties to the Bikinate of Quina, which can be separated from it in the same manner as the Kinate of Cinchonia from the Pale Bark. The kinate in the natural Bark is intimately combined with red cinchonic. It contains, besides kinate of lime, tannic acid, yellow colouring matter, fecula, fatty matter, and lignin. When cold water is poured into a strong decoction of Yellow Bark, the red cinchonic is thrown down. The bitter principle which M. Buchner has separated from the Bark of Portlandia *grandiflora*, and which he has termed Amer Kinovic, is also found in Yellow Bark. It is obtained by acting on the finely-powdered bark by Ether, evaporating the etherial tincture, digesting the residue with alcohol, and, after decolouring this tincture and diluting with water, precipitating with ammonia. The precipitate is the bitter principle. It is combined with the Kinovic acid in the bark. Its constituents are, Carbon, 62·56, + Hydrogen 8·57, + Oxygen 28·87, = 100·00, or C. 17, H. 29, O. 6, = 181·04. It is a white, inodorous, pulverulent substance, crystallizing in scales when dissolved in alcohol: tasting at first farinaceous, but leaving on the palate a very disagreeable, persistent bitter. It is scarcely soluble in cold water, moderately in warm, very soluble in alcohol; not in ether, nor the fixed nor volatile oils; it melts like resin; and, at a high temperature, burns and leaves a light charcoal.

The officinal preparations of the Yellow Bark differ little from those of the Pale Bark.

DECOCTION OF YELLOW BARK, *Decoctum Cinchonæ cordifoliæ*, L. *Decoctum Cinchonæ*, E.—The London College orders ℥x of the bruised bark to be boiled with a pint of distilled water in a tightly covered vessel for ten minutes, and strained. The preparation of the Edinburgh College is the same as for the Decoction of the Pale Bark. The dose is from f℥iss to f℥ii.

EXTRACT OF YELLOW BARK, *Extractum Cinchonæ cordifolia*, L. is a simple aqueous Extract. The dose is g. v to ℈i.

TINCTURE OF CINCHONA, *Tinctura Cinchonæ*, L. E. is made with the Yellow Bark, in the proportion of ℥viii to Oii of proof spirit, either by means of the percolater or maceration. The dose is fℨi to f℥iii.

The Salts of Quina, besides the natural Bikinate, are Sulphates, Nitrate, Hydrochlorate, Phosphate, Citrate, Acetate, and Hydrocyanate. The Disulphate is most commonly employed.

Quina may be combined with two proportions of sulphuric acid; one forming a disalt, the other a neutral salt. The first is that in common use.

DISULPHATE OF QUINA, *Quinæ Disulphas*, L. *Quinæ Sulphas*, E. D. was discovered by Pelletier and Caventou, in 1820. It is pure white, in uniform silky needles, inodorous, intensely bitter, little soluble except in boiling water at 60°, but

completely soluble in 30 parts of water at 212°. Its solubility is increased by acidulating the water with sulphuric acid. The crystals are soluble in 60 parts of rectified spirit. They effloresce in the air, losing ⅝ of their weight; are phosphorescent in a temperature of 210° Faht.; and decomposed by all substances that form salts with sulphuric acid and with Infusion of Galls. It is readily distinguished from sulphate of Cinchonia by its crystals, being acicular instead of lamellar.

The components of the Disulphate are 2 eq. Quina, + 1 sulph. acid, + 8 water: equiv. = 441·20, or

DISULPHATE.

	Crystallized.	Effloresced.
Quina	74.31	88.899
Sulphuric acid	9.17	11.111
Water	16.52	
	100.00	100.000

The neutral Sulphate is formed by adding Sulphuric Acid to the Disulphate. It crystallizes with difficulty in square or rhombic prisms. It is soluble in 10 parts of water at 60°, and its own weight at 212°. Its components are 1 Quina, + 1 acid, + 8 water: equiv. = 276.65, or

NEUTRAL SULPHATE.

Quina	59.1	81.819
Sulphuric acid	14.6	18.181
Water	26.3	——
	100.0	100.000

It readily dissolves in diluted alcohol, but with difficulty in strong alcohol. It would be better, were the neutral used instead of the disulphate, as it is very soluble, and the disulphate is generally converted into it, in extemporaneous prescriptions, by the addition of sulphuric acid.

The processes for making the Disulphate of Quina are extremely different; all act on the same principle. The Bark is first exhausted by water acidulated with sulphuric acid, and decomposes the sulphate by a carbonate of an alkali or hydrated oxide of lead: the former is used by the Edinburgh College, and it is better than the oxide of lead for the purpose The Quina thus formed is again united with sulphuric acid, largely diluted with boiling water, and the crystals purified by two crystallizations. The quantity obtained must necessarily differ with the quality of the bark: but the average is from 1½ to 3 per cent.

Disulphate of Quina is sometimes adulterated. When the adulteration is white sugar, it is detected by the solution of the suspected salt in as much carbonate of potassa as will saturate the sulphuric acid: if sugar be present, it will then be perceived

by the taste. If the adulteration be starch, a portion of the suspected salt will remain insoluble in cold water; and if the mixture be heated to 170° Fahr. then cooled, and the tincture of iodine added, the starch will be made evident by the formation of Iodine of Amidine. Boracic acid, with which it is also adulterated, is detected by dissolving the salt in alcohol and setting fire to the solution: if that acid be present, the flame will be green. It is more difficult to detect the sulphate of lime, which is manufactured in acicular crystals, expressly for the purpose of adulterating the Disulphate of Quina: it may, however, be detected by exposing the suspected salt to a red heat: the Sulphate of Quina is destroyed, but the Sulphate of Lime merely loses its water of crystallization; and, when mixed with water, it will rapidly absorb the fluid and solidify in a few seconds. If the adulteration be an anhydrous sulphate of lime, it will remain insoluble in water, whilst the Sulphate of Quina dissolves.

Pure Disulphate of Quina is precipitated from its aqueous solution by acetate of lead; an insoluble sulphate of lead is formed, whilst an Acetate of Quina remains in solution. With the infusion of galls, an insoluble tanno-gallate of Quina is thrown down: and, by lime-water, both the sulphate of lime and pure Quina are precipitated. No change is produced by the salts of iron—a great advantage in the treatment of amenorrhœa in debilitated habits.

Acetate of Quina.—Acetic acid readily unites with Quina, and forms a salt, which crystallizes in long, pearl-coloured needles, that are often grouped into stars: it is very soluble, and possesses the same medicinal powers as the disulphate.

Hydrochlorate of Quina is formed by the direct combination of its components. It crystallizes in silky tufts.

Phosphate of Quina, made in the same manner, crystallizes in pearly needles.

Arseniate of Quina crystallizes in prismatic needles.

Both the kinate of Cinchonia and that of Quina are found in the officinal red bark.

The precipitate which the infusion of galls forms with the salts of Quina affords a ready method of ascertaining the value of specimens: of the yellow bark, the greater the precipitate is, when infusion of galls is added to the infusion of the bark, the richer it is in the alkaloid which it contains.

Although the Pale Bark yields chiefly *Cinchonia,* with a small quantity of Quina, and the Yellow chiefly *Quina,* with a small proportion of *Cinchonia,* yet the quantities of the opposite principles are too small to give a character to the medicinal properties or the chemical nature of these Barks.

Red Cinchona Bark, *Cinchonæ oblongifoliæ cortex,* L. D. *Cinchona rubra,* D.—This is improperly supposed to be the Bark of Cinchona *oblongifolia* of Mutis, which grows in New

Granada, near Maraquita, and yields a Bark known by the terms Quina de flor de Azahar, Cascarilla de Loxa, Cascarilla Azahar, and Cascarilla Maraquita de Loxa. The C. *magnifolia* of Ruiz and Pavon, found in the Andes, has also been supposed to yield the Red Bark; it affords the Quina Amarilla of the Spaniards, the Quina rouge de Santa Fé, and the Quina rouge orange plât, of the French. The botanical source of the Red Bark is unknown. There are two kinds, *smooth Red Bark:* the second kind is called *warty Red Bark.*

1. *The smooth Red Bark* of commerce is imported in both quilled and flat pieces, seldom exceeding ten or twelve inches in length, of a lively red colour, fibrous, very hard, covered with a rough, but not warty, epidermis, transversely cracked, and not much covered with lichens. The cortical part is about a quarter of an inch in thickness, and breaks with a fibrous fracture. Immediately under the cuticle, there is a dark red, resinous matter deposited in the fibres, in the form of an agglomerated powder, which has a deeper colour than the rest of the bark.

2. *The Red Bark of Santa Fé* is in thick quills, nearly an inch in diameter, very rough and warty on the exterior, cracked in different directions, and exhibiting deep fissures: interiorly, it has a bright red colour, is brittle, and breaks with a fibrous fracture: when moistened, it has a peculiar, not agreeable odour: is unpleasant in the mouth; and, although less bitter and acrid than the pale and the yellow barks, yet it is more acrid, austere, and nauseous. This bark is essentially different from that which is found in the shops. The *Infusion of Red Bark* is slowly precipitated by the infusion of gall-nuts, and of other astringent vegetables; and a very light, flocculent precipitate only is thrown down by gelatin. Both protosulphate and persulphate of iron strike a deep bluish colour with it, but afford little precipitate. It is also precipitated by tartar emetic and bichloride of mercury. The tincture is effected in the same manner as the infusion.

According to the analysis of Pelletier and Caventou, this bark contains—an equal quantity of acidulous kinate of Cinchona and acidulous kinate of Quina; a red cinchonic; much tannic acid; a yellow colouring matter; a fatty matter; kinate of lime; starch; and lignin. From the effects of the sulphates of iron in its infusion, it is probable that it also contains traces of gallic acid, in combination with the tannic. It is more astringent and stimulant than the other officinal species.

I have stated that there are evidently many varieties of bark in the same package. Formerly, this was of little importance: but, on account of the distinct salts contained in the different species, a knowledge of these has become necessary. The experiments of Pelletier and Caventou have demonstrated that the quantity of the active principle is least in the Pale Bark, the

proportion of kinate of Cinchonia being only as two to nine of kinate of Quina found in the Yellow Bark, whilst the quantity of each, in Red Bark, is in the proportion of eight of the kinate of Cinchonia and seventeen of kinate of Quina: hence, if the febrifuge powers of the bark depend on these salts, the Red is the most efficacious.

With regard to the medicinal history of Cinchona Bark, numerous fables have been propagated. Humboldt has ascertained that it was unknown to the Peruvians before the Spanish conquest. It was introduced into notice in Europe in 1640, from a cure having been effected on the Countess of Cinchon, the wife of the Viceroy of Peru, after whom the genus is named.* The first treatise on its virtues was published in 1742, by Professor Barla of Valladolid. The extension of its employment in Europe was chiefly due to the Jesuits; hence it was long known by the appellation "Jesuits' Bark." The secret of the Jesuits was discovered by Talbot, an Englishman, who sold it to Louis XIV: but still, although the value of Cinchona Bark, as a remedy, was acknowledged, yet the plants yielding it were unknown until 1737, when Dr. Arrot, a Scotch physician in Peru, was the means of an account of it being published†: but, from what has been detailed, it is scarcely necessary to say that the botanical history of the genus is not much more known than at the period alluded to.

Cinchona Bark is a decided Tonic, with some degree of astringency.

If a drachm of powdered Cinchona Bark, *pale*, *yellow*, or *red*, be swallowed, once in three or four hours, by a healthy person, it causes a dryness of the mouth, a sensation of weight and uneasiness at the stomach, and augmented force in the circulation of the blood, an increase of perspiration, an elevation of temperature, accompanied with redness of the skin, and other symptoms of excitement, demonstrating the stimulant power of the remedy. These effects, when the dose is small, although weaker, yet are permanent: we feel authorized, therefore, to regard Cinchona as a real *Tonic*. With respect to its power in changing diseased into healthful action, and restoring the vigour and energy of the debilitated frame, every day's experience has proved its efficacy, and that of its active principle, especially in fevers of an intermittent and remittent character. Much was said, at one time, about the period of fever in which Cinchona Bark ought to be administered. Dr. Clarke of Newcastle, and others, gave it at every period, and cured the disease: and Dr. Heberden, in his Commentaries, remarks—"Unde dicidimus suspicionem periculi a cortice, etiam sub ipsa febre adhibito,

* A brief history of its various fortunes is contained in the London Dispensatory.
† Phil. Trans. 1737.

fuisse non minus vanam, quam multas alias suspiciones, quas majores nostri de utilissimo hoc remedio sparserunt*." Nevertheless, Cinchona Bark is seldom given during the paroxysm, but in the intervals, augmenting the dose towards the accession of the next attack. The remedial effects of the Barks depend on their alkaloids: their other principles exert only a secondary influence. The kinic acid increases the solubility and activity of the Cinchonia and the Quina: but when these are united with mineral acids, especially the sulphuric, they are better Tonics. In their administration, we ought always to direct our attention to the state of the stomach and intestines before prescribing them; and not to administer them if these important organs be in an irritable condition, or if general inflammation be present.

Cinchona Bark, and the salts of its alkaloids, may be prescribed advantageously in all diseases which assume an intermittent type. Whenever a true periodic character occurs, the Bark proves serviceable, and rarely injures. Even in local affections this rule holds good. In a case recorded by Sir B. Brodie, a gentleman, who had lived long in a tropical climate, became affected with stricture of the urethra of a spasmodic nature, which recurred every alternate night about twelve o'clock, and continued until five or six o'clock in the morning. It was cured, by anticipating the paroxysm and administering disulphate of Quina, in large doses, at short intervals of time. In the intermittents of warm climates, Cinchona may be conjoined with calomel and aloës; and, even in this climate, the intestines should, in every instance, be kept rather in a lax state during its exhibition, or that of the sulphates of its alkaloids.

In many chronic diseases, although intermissions do not occur, Cinchona Bark and its alkaloids are beneficially administered. Thus, in chronic and pulmonary catarrh, kept up by a weakened habit; in chronic diarrhœa; in passive hæmorrhages; in scrofulous conditions of the system; in dyspepsia; anorexia; and every case of direct debility, they may be prescribed with advantage. I am in the daily habit of prescribing them in cases which are regarded as neuralgia, in which the pain returns at stated intervals. In that peculiar inflammation of the sclerotic coat of the eye which assumes the characteristic of rheumatism, they may be regarded almost in the light of specifics.

But, notwithstanding the substantial benefit resulting from the administration of Cinchona Bark, and the salts of Quina and of Cinchonia, in these diseases, some caution is requisite in prescribing them. They are hurtful when hepatic symptoms are present: they should never be ordered until all inflamma-

* Commentarii de Morb. Hist. cap. 37.

tory action is subdued by bleeding and other means: and in every case their use should be prefaced by purgatives. Local and topographical circumstances also vary their efficacy. Thus, Mr. Annesley, in his work on the Diseases of India, states that although the Bark is the grand remedy in fevers in India, during the cold season, yet it fails in the rainy season, in which calomel and antimony only prove useful.

The British Pharmaceutical preparations of the three species of Cinchona used in this country have been already noticed; but the value of each may be here particularly examined. The *powder* was formerly given in doses of gr. x to ʒvi, every second or third hour, during the intermissions, in agues: but the bulk, which alone was often such as to nauseate, was always regarded as an objection to this form of the medicine. The best vehicle for administering it is milk, which effectually covers the taste of the bark, if the dose be swallowed the instant it is mixed with the milk. If *decoction* be preferred, care should be taken not to prolong the boiling beyond ten minutes; as long boiling converts the tannic acid into oxidized extractive, which, precipitating, carries down with it much of the kinates. In the decoction, the precipitates formed on cooling should be suspended by means of mucilage; for these contain a large proportion of the kinates. *Infusion* in boiling water, acidulated with diluted sulphuric acid, is a useful preparation. Neither decoction nor infusion are useful in agues. They prove very beneficial as Tonics; and, besides being administered as such, they are also employed as topical remedies—namely, gargles, in combination with the chloride of soda, or with hydrochloric acid, in malignant scarlatina; and, also, as lotions in gangrenous sores: the bark, thus used, changes the morbid action of the part, and aids cicatrization.

The Tinctures contain all the active principles of the bark; the diluted alcohol dissolving the kinates of the alkaloids, and scarcely touching the kinate of lime. A *Wine* is employed on the Continent; and in this country wine is used as a vehicle for the powder. The French Codex orders a syrup; but it is a feeble preparation.

The *Extracts* are prepared both with water and with diluted alcohol. The alcoholic extract contains all the active constituents of the bark: if it be repeatedly washed with distilled water, the whole of the kinates are separated, and the red insoluble matter only remains: hence the natural kinates can be readily obtained.

The best preparations are the disulphate and the sulphate of the alkaloids. It may be reasonably demanded, in what do these salts differ? In a medicinal point of view, my experience does not authorize me to assert that either possesses properties not common to both: but M. Bally has stated that the disulphate

of Cinchonia is more stimulant than the disulphate of Quina. To obtain the full effect of the disulphate of Quina, in ague, the best mode of prescribing it is to dissolve two or three grains in an infusion of the confection of roses, filtered and acidulated with diluted Nitric acid, and to add f℥i of tincture of orange peel, which covers the extreme bitterness of the solution*. This dose of the disulphate should be given every second hour, during the interval, so that the last dose may be taken half an hour only before the anticipated paroxysm. Dr. Elliotson says that the preferable mode is to give a large dose—gr. x, for instance—either before or immediately after the paroxysm: but, in my practice, small doses, frequently repeated, have proved more useful than one large dose. I have given it, in appropriate doses, to infants labouring under intermittent fever, with the best effects.

In some cases, however, when taken into the stomach, it has produced symptoms almost indicative of inflammation of that organ; to obviate which, Signor Broglia dal Persico proposes to cure agues by dusting from two to six grains of the disulphate, in fine powder, on blistered surfaces: he affirms that the salt thus applied may be detected in the stools. M. Pointe, a physician in Lyons, has also proposed to introduce it into the habit by absorption. His plan is to rub the gums and the inside of the cheeks with the disulphate, very finely powdered, for ten or fiften minutes, or until all the powder be absorbed; cautioning the patient not to swallow the saliva. He affirms that, thus applied, the sulphate acts with as much energy as when taken into the stomach, without exciting any irritation of the mucous membrane, which, he contends, it is always apt to induce. I can bear testimony to the efficacy of this mode of introducing the salts of Quina into the habit.

The sulphates of Quina and Cinchonia may be also administered per anum: they cure ague, but cause violent colic.

d. Piperina.—This is a peculiar principle, which was discovered, in 1819, by M. Oerstadt, of Copenhagen, in Black Pepper. Its discoverer regarded it as an alkaloid: M. Pelletier, who carefully examined it in 1821, disproved this opinion, and classed it as a resinoid. It is procured in white or pale-yellow, semi-transparent, flattish quadrilateral prisms, with two parallel large and two small sides, terminated by an inclined plane; these are insoluble in cold, and even scarcely soluble in boiling water, and they precipitate as the water cools: but they are soluble in alcohol, in ether, and in acetic acid. The alcoholic solution is rendered milky on the addition of water, like resinous, spirituous solutions. The crystals of Piperina

* It is a curious, although not easily explained, fact, that the bitterness of the disulphate is completely covered by aromatic bitters, such as gentian root, orange peel, and cascarilla.

are fusible at 212°. The diluted mineral acids do not act upon them; but the strong acids alter their properties: thus, sulphuric acid gives them a *blood*-red colour; the nitric first produces a *greenish-yellow*, then an *orange*, and, lastly, a *red* colour; and the hydrochloric changes their natural yellow to a deep *yellow* hue.

The process for procuring the Piperina is very simple. Two pounds of pulverized Black Pepper (p. 82) are boiled in three pounds of alcohol at 36° Beaumé, and the tincture left at rest until it is cold, and decanted; and this operation is repeated with fresh alcohol: or the alcohol is passed through the ground Pepper in a percolater, until it is exhausted. Two-thirds of the spirit is then distilled off, and two pounds of distilled water, containing f℥iii of hydrochloric acid, are next poured on the alcoholic solution; the fluid becomes turbid, and deposites a precipitate of a deep grey colour, which consists partly of fatty matter, on removing which, beautiful crystals of Piperina appear upon the sides of the vessels, and on the filter. By adding fresh water to the liquid as long as it becomes turbid, fresh crystals are procured. The concrete oil, which is separated, is of a dark green colour, excessively acrid, and very soluble in alcohol.

Piperina is also obtained from White Pepper, but in smaller quantity than from Black Pepper. It is also procured by a similar process from Long Pepper, and I have succeeded in obtaining it also from Chamomile flowers. Impure Piperina, such as it is usually prescribed, is not simply Tonic, but it is a powerful excitant, resembling the acrid oil of Pepper in its action. In some habits it acts upon the bowels, causing gripings and watery stools; and, in others, it seems to have produced a pustular eruption, with severe itching and exfoliation of the cuticle. In this case, it is difficult to say whether the acrid oil or the Piperina should be regarded as causing these symptoms.

If we enquire into the value of Piperina as a Tonic medicine, we find that Pepper entered into many of the prescriptions of the ancients; but it does not appear that it was employed by them as an anti-periodic. It is not easy, therefore, to determine the origin of the popular opinion* in its favour as a remedy in these diseases: and it was not until after the discovery of *Piperina* that any idea could be formed of the cause of its beneficial effects. The first satisfactory account of the medicinal properties of Piperina was published by Dr. Meli of Ravenna, in a work entitled "Nuove Esperienze ed Observazioni sul modo ottenerve dal Pepe nero il Peperino e l'Olio acre." It has been successfully employed as a Tonic on the Continent; but it is rarely used in this country; hence, farther experience

* A mixture, or rather tincture, of Black Pepper in gin or rum, has long been regarded as a specific for ague among sailors.

is requisite to determine its value. Dr. Gordini, of Leghorn, asserts that, in periodical fevers, he has found it prove successful when disulphate of Quina has failed. He gave it in doses of from gr. viii to gr. x every fourth hour during the apyrexia*. The same superiority of Piperina, in breaking the catenation of diseased actions in Intermittents, has been found by Dr. Hartle, in Trinidad. He gives it in doses of gr. v every second hour during the intervals. He affirms that it does not, in the smallest degree, affect the sensorium. If it be found to realize the anticipations of those who have introduced it, some method of procuring it at a more reasonable rate should be discovered; and the reintroduction of the use of one of our indigenous plants, Chamomile flowers, which contains it, as an anti-periodic, may be attended with beneficial effects.

c. CHAMOMILE FLOWERS. *Anthemis.* L. E. *Flores Chamæmeli,* D.—Chamomile flowers are the production of the Anthemis *nobilis,* an indigenous plant, belonging to the division *Asteraceæ,* of the natural order *Compositæ*†. The plant, in its natural state, is prostrate, with small, sessile pinnatisect leaves, and flowering branches, naked and one-headed at the apex. The florets of the disk are tubular and yellow; those of the ray,

* *The following extract of a letter from J. Adamson, Esq. of Rye, to Charles Knight, Esq., at the date of the letter, one of my pupils, is illustrative of this point.*

DEAR SIR, Rye, April 14, 1829.

The cases in which I have used the Piperine, in its *crystallized state,* have been most satisfactory. The first person upon whom I tried it was a man of the name of George Avery. I visited him during the third paroxysm, and ordered one grain of Piperine to be taken every two hours between the paroxysms. The next day he had a most terrible fit of the "vulgar gripes," which, however, was speedily removed by an aperient. The ague did not return, and he has been free from it to this day. Another man, Henry Heath, had two paroxysms. He took gr. i every two hours, and had no return The pain in the bowels also appearing in this man, I determined, in future, to give an aperient at first starting, which has completely prevented, in other cases, any griping. Hodges, of the Staff Corps; Catt, Winchelsea Marsh; Jarratt, near the Bank; Mrs. Watson's cook; Mrs. Wood, of the workhouse; Mrs. Peedle, and many others; have experienced equal benefit: and, I think, afford sufficient evidence of the efficacy of Piperine in intermittents. There is one case to which I wish particularly to direct your attention and recollection—Crowhurst, Vidler's foreman This man has suffered from ague for, I think, nine months; it could be moved by nothing. He, as you may remember, wished to try the Piperine. He took the usual dose with decided effect; for the paroxysm was evidently weakened; but, the stomach having got accustomed to the action of Piperine, whether stimulant or tonic I will not determine, the enemy returned, and there remained, in spite of the doses of Piperine, and small or large doses of sulphate of quina, or any thing else which was given. I mention this case to shew, that, where the Piperine has failed, the sulphate of quina has bad no better effect. But I dare say you will ask—How does it answer now? To be candid, I have discontinued the use of it; not from doubting its power, but from the four following reasons:—1st, the expense of preparing it in comparison with the price of sulphate of quina; 2ndly, want of time and opportunity to prepare it; 3rdly, its inconvenient form of exhibition, only in the form of pills; and, 4thly, the spirituous extract, which you remember you prepared before you left, I find to be perfectly useless; you may as well give so many pepper-corns.

† Woodville's Med. Bot. third edit. p. 47, pl. 19. London Dispensatory, arc. Anthemis. Richard, Hist. Nat. Med. t. ii, p. 218. Lindley, 459. Hayne, x, 47.

ligulate and white; receptacle convex, with scales between the florets. The plant is extensively cultivated, and the florets of the disk, from that circumstance, are converted either partially or wholly, into ligulate florets; but as their medicinal properties are thus diminished, the single flowering variety only should be employed.

Chamomile flowers have a strong, peculiar, but not unpleasant odour, and an aromatic, warm, intensely bitter taste. Both water and alcohol extract their medicinal properties. The volatile oil which gives them their odour and aromatic quality can be separated by distillation*. Boiling in alcohol separates from them a concrete fat oil, which is deposited as the solution cools; and in it Piperina exists, and separates from it when it is treated in the same manner as Pepper. The infusion and tincture of Chamomile flowers are copiously precipitated by the acetate of lead; the sulphates of iron which strike a blue-black; and also by decoction of yellow cinchona. From these results, we may conclude that Chamomile flowers contain a *fat* or *oily matter*, *volatile oil*, *bitter extractive*, and *tannic acid*; probably, also, gum and some salts. Their officinal preparations, employed as Tonics, are *infusion*, *decoction*, and *extract*.

Infusion of Chamomile, *Infusum Anthemidis*, L. E. *Infusum Chamæmeli*, D. is prepared by infusing ʒv of the flowers in Oi of boiling distilled water for ten (twenty, E.) minutes, (twenty-four hours, D.) and then straining. It is employed cold, as a Tonic, in doses of f℥i to f℥iii.

Compound Decoction of Chamomile, *Decoctum Chamæmeli compositum*, D. is made by boiling for a short time ʒii of the flowers, ʒii of the seeds of Sweet Fennel, and Oi of water; and straining. It is an unnecessary preparation, as it answers no purpose for which the Infusion is not equally applicable.

Extract of Chamomile, *Extractum Anthemidis*, E. *Extractum Chamæmeli*, D. is the result of the evaporation of the decoction of the flowers. It is little more than a simple bitter; the greater part of the volatile oil being driven off by the boiling and evaporation; consequently the remedy, as far as respects its aromatic property, is deteriorated. The dose is gr. x to ʒss.

The tonic properties of Anthemis *nobilis*, administered in moderate doses, have been long known; and, before the introduction of the Cinchona barks, the pulverized flowers were successfully administered in intermittent fevers†. In large doses of the powder, and in strong decoction or infusion, they prove emetic; but the officinal infusion, or one lighter, made at a temperature

* *Oleum Anthemidis*. L. E. In doses of m. v to m. xv, administered as an Oleo-saccharum; it is an excellent carminative in flatulent colic.

† Morton, Exer. 1 de febr. intermit. cap. 6. Pringle, Diseases of the Army, p. 216. Cullen, Mat. Med. vol. ii, p. 79.

under 120°, are excellent tonics, in convalescence from acute diseases, dyspepsia, gout, and chronic debility.

f. GENTIANIA, *Gentisic Acid.*—This is procured in yellow, inodorous, acicular crystals, not very soluble in water, and only moderately in alcohol and ether. Gentiania, as discovered by MM. Henry and Caventou, has been found to be a compound of an insipid, inodorous acid, named *Gentisic,* discovered by Leconte, whose opinions were confirmed by Tromsdorff, in 1837*, and an odorous, bitter principle; Richard had previously declared its acid character. Both the Gentiania of Henry and Caventou, and the Gentisic acid of Leconte are expensive preparations, and neither are medicinally used in this country. They may be procured from the roots of the Gentiana *lutea* and other species of the genus Gentiana.

M. Majendie tried the medicinal properties of Gentiana carefully prepared. He says it proved to be an excellent Tonic, and so little poisonous as to produce no bad consequences even when injected into the veins. There is only one species of Gentian officinal, namely—

YELLOW GENTIAN, *Gentiana Lutea,* a plant which grows in great abundance in the Alps of Switzerland and Austria, the Apennines and the Pyrenees, on the mountains of Vosges and Auvergne, and in North America. It belongs to the natural order Gentianaceæ†. It is a tall plant, rising from two to five feet in height, with opposite, sessile, ovate, entire seven-ribbed, plaited leaves: the upper ones are amplexicaul and concave. The flowers are axillary, on smooth, short peduncles, both calyx and carolla is yellow; the ovary conical, with five greenish glands at the base; and the capsule conical and two-valved. The root only is used, although the whole plant possesses the same properties as the root.

THE ROOTS OF GENTIAN, *Gentiana,* L. E. *Gentiana lutea. radix,* D. are in rough twisted pieces, more or less branched: they have a faint aromatic odour, and an intensely bitter, but not nauseous taste. The epidermis is wrinkled, of a brownish-yellow colour, and is separated from the central part, which is of a greyish-yellow hue and spongy, by a dark reddish-brown layer. They are tough and easily sliced. Their sensible qualities, which are not perfected until they are four years old, may be extracted by ether, alcohol, and water. They contain—a *bitter principle; a very fleeting, odorous matter; a substance resembling bird-lime,* which Leconte has demonstrated to be a compound of

* Journ. de Pharm. t. xxiii. p. 469. Gentisic acid forms salts with the alkalies. The Gentisate of Soda crystallizes in long, acicular, golden yellow crystals, which are decomposed by solution in water.

† Woodville's Med. Bot. 3d edit. p. 273, pl. 95. London Dispensatory, art. Gentiana. Richard, Hist. Nat. Med. t. ii, p. 127. Lindley, 519; Hayne xiii, 28.

wax, oil, and caoutchouc; *a green fixed oil; a free acid, gentisic,* in small quantity; *uncrystallizable sugar; gum; a yellow-colouring matter;* and *lignin**. The fugaceous nature of the colouring matter accounts for the effects of acids and alkalies on the infusion. Neither the salts of iron nor the nitrate of silver throw down precipitates in the infusion—a very convenient circumstance in its medicinal administration. It is copiously precipitated by acetates of lead and the decoction of yellow cinchona bark. Besides diluting the colour, acids greatly diminish the bitterness of the Gentian root; whilst alkalies increase both the colour and the bitterness. Owing to the saccharine principle contained in the Gentian, the infusion very rapidly ferments and spoils.

Fabulous history carries the discovery of the medicinal properties of Gentian to high antiquity; assigning it to Gentius, king of Illyria, who lived 167 years before the Christian era, after whom the plant is named†. It possesses considerable tonic powers, exciting appetite and promoting digestion. It is taken into the circulation, and accumulates in the habit. Cullen says that Gentian, combined with galls or tormentil, in equal parts, and given in sufficient quantity, cures intermittents; shewing the advantage of combining astringents with bitters when we desire to extend their influence on the system. This root had formerly a high character as a gout medicine, and was an ingredient of the celebrated Portland powder.

Gentian-root is administered in the forms of *Infusion, Extract, Tincture,* and *Wine.*

Compound Infusion of Gentian, *Infusum Gentianæ compositum,* L. D. *Infusum Gentianæ,* E. are both compound Infusions. The first is made with ʒii of sliced Gentian, ʒii (ʒi, D.) of dried Orange peel, ʒii (ʒi, D.) of fresh Lemon peel, and Oi (℥xii, D.) of boiling distilled water: for the second, are ordered, Gentian, sliced, ʒiv, dried and bruised bitter Orange peel ʒi, Coriander seeds ʒi, Proof-spirit f℥iv, and cold water f℥xvi. The spirit is first poured on the solids; and, three hours afterwards, the water; and in twelve hours the whole is strained through linen. The Edinburgh Infusion is less apt to ferment than the other: it is the best form for administering Gentian; and the facility of combining it with acids, or alkalies, or the salts of silver, iron, and zinc, renders it an excellent vehicle for these medicines in all cases of direct debility‡.

* Journ. de Pharm. tome vii, p. 173.

† It formed a part of the celebrated antidote of Mithridates, which, says Celsus, was called most noble: "quod quotidie sumendo rex ille dicitur adversus venenorum pericula tutum corpus suum reddidisse"—an excellent commentary on the state of medicine at that period, and a striking instance of the antiquity of that credulity which still adheres to titled ignorance on the subject of remedies.

‡ It is said that the root of the Gentiana *acaulis,* a beautiful indigenous mountainous species, with a solitary, large, bell-shaped flower, possesses all the medicinal properties of the yellow Gentian root, without the disadvantage of the gum. This deserves a trial.

The officinal infusion is a compound of Gentian, orange peel, and lemon peel, and is an excellent vehicle for sulphate of quina.

COMPOUND TINCTURE OF GENTIAN. *Tinctura Gentianæ composita*, L. E. D.—The formula of the London and Dublin Colleges differs from that of Edinburgh. In the two former, ℥iiss (℥ii, D.) of sliced Gentian, ʒx (ʒviii, D.) of dried Orange peel, ʒv (ʒiv, D.) of Cardamom bruised, and Oii (f℥xxxii, D.) of Proof spirit, are ordered. In the latter, ℥ii of the Gentian, ℥i of Orange peel, ℥ss of Canella in fine powder, and ʒi of bruised Cochineal, are ordered to be either digested in Oii of Proof Spirit, strained by pressure and filtered; or prepared by percolation. The dose is fʒi to fʒii.

EXTRACT OF GENTIAN. *Extractum Gentianæ*, L.E.D.—This is a simple and a good preparation. It may be given in doses of from ten grains to half a drachm, twice or thrice a day. It has one peculiarity of great practical value; it prevents the nauseating influence of Ipecacuanha, without impairing the properties of that medicine when it is given in large doses.

COMPOUND WINE OF GENTIAN. *Vinum Gentianæ compositum*, E.—This might be with more propriety named *Compound Wine of Yellow Bark:* boing made with ℥i of that bark, ℥ss of Gentian, ʒii of dried Orange peel, ʒi of Canella, all in powder, and f℥ivss of Proof spirit, with f℥xxxvi of Sherry. The dose is fʒiv to f℥i.

g. CHIRETTA. *Chiretta*, E.—This is the herb and root of Agathotes *Chirayta**, a plant belonging to the natural order Gentianaceæ. It is an annual, rising erect, with a straight single stem, to the height of three feet. The leaves are opposite, amplexicaul, lanceolate acute, entire, three or five nerved. The flowers are yellow, numerous on the upper half of the plant, in an elegant, leafy, oblong, decussated panicle with two small bractes at each of its divisions.

The whole plant is bitter, but the root is most bitter. The bitterness is imparted both to water and spirit. The only officinal preparation is the INFUSION, *Infusum Chirettæ*, E. made with ʒiv of the herb and Oi of boiling water. The dose is f℥i to f℥iii.

Chiretta has long been used as a Tonic, in dyspeptic affections, in India; and has lately been introduced in England as a gout medicine. MM. Lassaigne and Boissel have analyzed it, and found in it—a yellow bitter principle; a brownish colouring matter; resin; gum; malic acid; malate of potassa; silex; and some traces of oxide of iron†. It does not appear to possess any advantages over Gentiana *Lutea*.

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* Don. Lond. Phil. Mag. 1836, p. 76. Roxb. flor. Ind. ii. p. 71. Lindley, 519.
† Journ. de Pharm. t. vii, p. 28,

h. SALICINA. — This is a resinoid, discovered by MM. Belke, Buchner, and Leroux, in the bark of some species of the willow tribe*. It is procured in white, hexangular, scaly crystals, very bitter, slightly aromatic, soluble in about 20 parts of cold, very soluble in hot water; soluble also in alcohol; but not in ether, nor in volatile oils. It is fusible at 212°. Sulphuric acid, at a low temperature, reddens it deeply; muriatic acids dissolve it; and it may be changed into resin by the action of both these acids, and by heat. Duflos prepared it by boiling the bark in three successive waters; evaporating till the decoction is the triple of the bark used (say 1lb. bark, 3lb. decoction): then adding litharge in fine powder, and digesting twenty-four hours; repeating this two or three times. The solution is then evaporated to the consistence of syrup, and the crystals that form are purified by repeated solution and crystallization. Erdmann has proposed another process. He macerates ℥xvi of Willow bark in a mixture of ʒii of lime in Oviii of water; and afterwards boils for half an hour. This is repeated twice with the residue. The clear decoctions are next concentrated to Oii, and digested with animal charcoal, filtered and evaporated to dryness. The extract is next exhausted with spirit, containing 28 per cent. of alcohol, the spirit nearly distilled, and the residue left to crystallize. A second crystallization and digestion in animal charcoal purifies them. Sixteen ounces of the bark yield ʒv of the salt.

To ascertain whether the willow bark contains Salicina, boil ʒi of it in f℥iv of distilled water; digest in the decoction ʒi of litharge in fine powder; filter and precipitate the lead with sulphuretted hydrogen gas, then evaporate to f℥i. If, in this solution, sulphuric acid produces a bright purple-red, Salicina is present†.

Salicina is not precipitated from its solution by infusion of galls, acetate of lead, alum, nor tartar emetic. According to Pelouze and Gay-Lussac, it consists of

Carbon	2	eq.	(2×6.12)	$= 12.24$, or	55.491
Hydrogen	2	——	(1×2)	$= 2$	8.184
Oxygen	1			$= 8$	36.325
			Equivalent	22.24	100.000

The following species of Salix are officinal.

1. Salix *fragilis*, Crack Willow‡, D. an indigenous species, growing upon the banks of rivers, flowering in April and May.

* Journ. de Pharm. 1829. This species of Salix, in which salicina has been found, are S. *fissa*, S. *helix*, S. *amydalina*, S. *vitellina*, and S. *incana*, *pentandra*, *alba*, *Russelliana*: it has also been procured from Populus *tremula*, P. *nigra*, P. *Græca*, P. *angulata*, and P. *alba*.

† Duflos, Schweizzer, Seidel Journ. 1833, p. 25.

‡ Richard, Hist. Nat. Med. t. i, p. 477—8. London Dispensatory, art Salix. Woodville's Med. Bot third edit. p. 13, t. 8. Smith's Flora Brit. 1051—1067—1071. Hayne, xiii, 41, 42, 43. Lindley, 317.

The bark is inodorous, bitter, and austere; but it yields little Salicina.

2. Salix *Caprea*. Round-leaved Willow, E. D. This is also an indigenous species; the bark is bitter and tonic.

3. *Salix alba*. White Willow, D. The bark of this species has been longest known as a medicinal agent: when dry, it is of a brown colour within; is very intensely bitter, acrid, and slightly aromatic. According to the analysis of Pelletier and Caventou, it contains, besides Salicina, a brownish red matter, soluble in alcohol, but little soluble in water; a green fatty matter, soluble in alcohol and ether; tannine acid, of a peculiar kind, which affords an abundant precipitate with gelatin, but not with tartar emetic; gum; and lignin. The Infusion and Decoction of White Willow Bark are bitter and astringent, and are precipitated by lime water; the carbonates of alkalies; the sesquisalts of iron, aud the salts of lead. All these precipitates are tannates of the bases, combined with the colouring principle.

It is evident that these barks possess a tonic power, acting on the tissues to which they are applied, and also on the general habit; and experience has fully confirmed their influence as an anti-periodic in intermittents. They require, however, to be prescribed in large doses: they may be administered in powder or infusion, or decoction, or in that of tincture, which contains all the active principles of the bark. But the discovery of Salicina, like Quina, has already superseded the use of these barks. This alkaloid may be administered in doses of gr. vi to gr. xii. It operates like the salts of Quina, but without causing headache when it is given in large doses.

f. QUASSINA.—This is prepared, according to Wiggers, by concentrating a decoction of the wood, agitating the decoction repeatedly, with lime, for twenty-four hours; evaporating the filtered fluid to dryness; then treating the residue with boiling, rectified spirit, and crystallizing. But the substance usually called Quassin, is obtained by evaporating a strong decoction of Quassia chips to the consistence of an extract: it is semitransparent, and of a brownish-yellow colour, soluble in water and in diluted alcohol, or what is termed proof-spirit, but not in strong alcohol and ether. It is a simple but good extract of the drug. The aqueous solution of Quassina precipitates the persalts of iron and the acetate of lead in yellow flakes, and the nitrate of mercury in white flakes. The extract does not precipitate tartar emetic, and does not throw down the protosulphate of iron, as it coutains no traces of either tannic or gallic acid. Quassina is the active principle of the following substances.

1. QUASSIA WOOD. *Quassia*. L. E. D*.—The Quassia

* Woodville's Med. Bot. third edit. p. 574, pl. 204. London Dispen. art. Quassia. Richard, Hist. Nat. Med. t. ii, p. 783. Swartz, Flor. Ind. acc. ii, 742. Lindley, 208. Hayne, (Simaruba *excelsa*) ix, 16.

Wood of the shops is not the wood of the Quassia *amara*, but of the Quassia or Simaruba *excelsa**, the Picræna *excelsa* of Dr. Lindley; belonging to the natural order *Simarubaceæ*. The wood of the former is nearly white, the bark thin, dense, brittle, yellowish-green, and easily separated; the pieces do not exceed an inch and a half in diameter. It is inodorous, and has an intense bitter taste. This wood is never imported for medicinal purposes. The Quassia of the shops is the wood of the Picræna *excelsa*, a handsome tree, a native of Jamaica and other West India islands, growing in the plains and hills, and rising to fifty or sixty feet in height. The leaves are alternate, pinnate, unequal, and the axis not winged, which distinguishes it from Quassia *amara*. The flowers are in axillary, compound, panicled racemes; small, pale-yellow, polygamous. The fruit is a drupe, generally three drupes form together, but one only ripens: the nut is solitary, globose, with a fragile shell.

Quassia Wood is brought home in billets, about the thickness of the human thigh, and cut into the chips found in the shops. It is firmer and yellower than the wood of the Quassia *amara*. It is sometimes covered with a bark of a dark greenish-brown hue, traversed by reticular lines. Water is the best vehicle for taking up its medicinal properties, which is a pure simple bitter. It is also taken up by rectified spirit. Both infusion and tincture are affected by the same reagents as the solution of Quassina.

Quassia was first introduced, as a medicinal agent, from being used as a secret remedy in fever, by a negro in Surinam, called Quassi, after whom the plant is named by Linnæus. It was at one time vaunted as capable of curing intermittents; but it has not maintained that character, although it is still regarded as a powerful Tonic; and of a nature that its infusion admits of admixture with the sulphate of iron, of zinc, and most of the metallic salts. It neither quickens the pulse nor augments the animal heat, nor operates on the bowels†. In combination with cretaceous powders, or the alkalies and aromatics, it is useful in atonic gout; but if any irritation exist in the stomach, it is injurious. Its vermifuge powers have been well ascertained: but all Tonics may be regarded as vermifuges. On the Continent, persons of sedentary habits take a table-spoonful of the infusion of Quassia an hour before dinner, as an aid to digestion. In South America, basins are made out of the wood of the Quassia, which are employed by dyspeptics, the wood communicating its bitter to the beverage which is put into it, and

* Linnæus, Decandolle, Hayne, Nees von Essenbech.

† Murray, Apparatus Medicam.

hence it proves Tonic*. Quassia is administered in the form of Infusion, Tincture, and Extract.

INFUSION OF QUASSIA. *Infusum Quassiæ.* L. E. D.—This is a simple infusion; but the proportions of all the Colleges differ. The London College orders ℈ii, the Edinburgh ℈iii, to Oi of boiling distilled water; the Dublin ℈i to f℥viii of the water. The dose is f℥i to f℥iii.

TINCTURE OF QUASSIA. *Tinctura Quassiæ.* E. D.—The proportions are ʒx of the chips to Oii of proof-spirit (E.); ℥i of the sawdust to f℥xxxii of proof spirit (D.). The dose is from fʒi to fʒiii.

COMPOUND TINCTURE OF QUASSIA. *Tinctura Quassiæ composita.* E.—This, in addition to the Quassia, contains the volatile oils of Cardamom and Cinnamon. It is a useful bitter. Dose fʒi to fʒiv.

EXTRACT OF QUASSIA. *Quassiæ Extractum.* E.—An evaporated infusion. Dose, gr. v to gr. xv.

SIMARUBA BARK. *Simaruba.* L. E. D.—This is the bark of the roots of Simaruba *officinalis* of De Candolle; Simaruba *amara* of Nees von Essenbeck and Lindley. It is a native of Guayana and Jamaica: is a tall tree, with long, creeping roots; alternate, pinnate leaves, having mucronate leaflets. The flowers are diœcious, small, yellow, and in branched scattered panicles. The fruit is a drupe, black and shining, and aggregated four or five together on a common peduncle. The bark of the root is the officinal part, being more active than that of the branches. It had been long employed by the inhabitants of Guayana before it was introduced into Europe in 1713. It is brought from Jamaica in pieces folded lengthways. It is very fibrous, thin, light, greyish or whitish, and warty exteriorly, and interiorly of a light reddish-brown hue. It is inodorous, and impresses a very bitter taste on the palate, but without any acrimony. It is so tough that it cannot be pulverized.

According to the analysis of M. Morin, of Rouen, Simaruba contains a resinous matter, a volatile oil having the smell of benzoin, malic acid, traces of gallic acid, quassina, ulmin and lignin, acetate of potassa, an ammoniacal salt, malate of potassa, and an oxide of iron†. Its active principles are taken up both by water and by rectified spirit.

The infusion is the only officinal preparation. The infusion contains all the virtues of the bark. It is precipitated by infusion of yellow bark and salts of lead, reagents which do not affect the infusion of Quassia; but, more particularly, by the bichloride of mercury and the alkaline carbonates. It is distinguished by the volatile oil, with which the bitter principle is

* I am informed that the wood of the Quassia *amara* is that which is used in South America, where the *excelsa* is altogether disregarded.

† Journ. de Pharm. Feb. 1812.

combined, and which, undoubtedly, adds to its powers as a Tonic. The tannin which it contains is too small to prevent the sulphates of iron from being combined with it; hence they may be exhibited with the decoction in the same manner as with that of Quassia. When prepared by boiling, the decoction deposites a copious resinous precipitate on cooling. In medicinal properties, the Simaruba Bark has not maintained the high character which introduced it into notice. It is now little employed, although it is a Tonic of considerable power, and has been justly regarded as the best remedy of the class. In dysentery, when the tenesmus continues, with a weak, sinking pulse, it allays this symptom, and any griping with which it may be accompanied; favours the secretions of the skin, and restores the tone of the intestinal canal.

INFUSION OF SIMARUBA, *Infusum Simarubæ*, L. E. D. is made with ʒiii of the bark, and Oi of boiling distilled water. The Dublin College orders ʒi to f℥xvi of water. The dose is f℥i to f℥ii.

Simaruba Bark is sometimes given in substance, in the form of powder, in doses of gr. xv to ʒss, combined with opium and aromatics; but it is an inconvenient form of the medicine.

COMMON CENTAURY. *Centaurium*. L. E. *Centaureum*. D.—This is the entire plant, stem, leaves, and flowering heads, of Erythræa *centaurium*, a beautiful indigenous plant, belonging to the natural order Gentianaceæ, which enlivens the fields with its pink corymbs of flowers in July and August*. It is a small plant, seldom rising above a foot in height; the stem is leafy, and sometimes branched near the summit. The lower leaves are obovate, the others are elliptic-lanceolate, three-ribbed and bright green. The flowers are in a dense corymb, and interspersed with opposite, awl-shaped bractes.

The infusion and decoction of the Lesser Century form a precipitate of an olive-green with the sulphates of iron, and the alcoholic solution leaves a resin when evaporated. Vauquelin found that it produces no precipitate with tartar-emetic, nor with gelatin. M. Moretti analyzed the summits of Lesser Century, and obtained a free acid, mucus, bitter extractive, lime, and hydrochloric acid, which was probably united to the lime. M. Chevalier procured from these summits a bitter crystallized matter†, probably Gentiania.

As a medicinal agent, the Lesser Century does not possess any properties different from those of Gentian and many other bitters; and, therefore, it might be advantageously rejected from the list of the Materia Medica.

* Woodville's Med. Bot. third edit. p. 275, pl. 96. London Dispensatory, art. Chironea. Richard, Hist. Nat Med. t. ii, p. 131. Lindley, 521. Hayne, 1, 290.

† Journ. de Pharm. t. v, p. 98.

g. BITTER EXTRACTIVE.

Bitter Extractive is found in many tonic vegetables, in combination with *fecula*, *tannic acid*, and *volatile oil.* In most works on chemistry which treat of vegetable bodies, it is mentioned as if it were a well-defined substance. Schrader is said to have obtained it pure from the bark of the Cinchona *lancifolia.* It is, nevertheless, difficult to say what Extractive is, in a strictly chemical point of view. The term is applied to that solid transparent residue which remains, in combination with other principles, when a vegetable infusion is slowly evaporated; which is insoluble in pure alcohol; is oxidized and rendered insoluble in water, when the solution containing it is long boiled; which forms an insoluble yellow precipitate when acted on by chlorine; is rapidly precipitated by Chloride of Tin; and is fixed as a dye, of a fawn-brown hue, by any substance yielding oxygen. Bitter Extractive is contained, in considerable quantity, in many roots, herbs, barks, and leaves, which possess tonic powers.

Extractive is inodorous; but it differs in taste according to the plant which yields it; hence it is probably never obtained in perfect purity. When the solution of Extractive is evaporated slowly, the residue is transparent; when rapidly, the oxidizement which occurs renders the Extractive opaque, and it ultimately loses its insolubility in water. This effect of boiling, or that of rapid evaporation on Extractive, explains the reason why long decoction of some of the medicinal barks renders them nearly inert; why extracts, not slowly prepared in a water bath, are seldom active medicines; and, also, why extracts prepared in vacuo are preferable to all others. The effect of alum, alkalies, and many of the metallic salts and the oxides, on vegetable infusions and decoctions, is explained by the result of these reagents on pure Extractive. Insoluble, nearly inert precipitates are thrown down; and, therefore, these reagents are incompatible in all vegetable infusions containing Extractive. Its presence is always easily ascertained by Chloride of Tin, and the power of the Infusion or Decoction to fix a permanent fawn colour on cotton soaked in alum. When submitted to destructive distillation, Extractive yields carbonic acid gas, carburetted hydrogen gas, and, if the heat be great, ammonia: hence, we conclude that its ultimate components are—carbon, hydrogen, oxygen, and nitrogen.

* *Roots containing Bitter Extractive.*

ROOT OF CALUMBA. *Calumba*, L. E. *Calumbæ Radix*, D.—This root was used long before the plant which yields it was known: it was named Colombo, from the place of its export in Ceylon. By the researches of Lamarc and of Dr. Berry, and

the careful examination of a plant reared from a root brought from Africa and planted in the Botanic Garden at Madras, it was ascertained to be the root of a plant growing in Mozambique and Oibo, on the coast of Africa. It was named Menispermum *palmatum* by Lamarc: but De Candolle discovered it to be a Coculus, and named it Coculus *palmatus*. It belongs to the natural order Menispermaceæ*. It grows in great abundance in the forests of Mozambique, where it is dug up in March by the natives, and transported to Tranquebar, whence it is shipped for Europe. Its native name is *Kalumb*, whence the officinal name Calumba.

This root is imported in transverse sections, of rather more than the third of an inch in thickness, and from an inch to two and a half inches in diameter. The centre, which is spongy and of a pale greenish-yellow colour, is covered by a thick, easily detached bark, the interior of which is of a bright yellow hue; and the epidermis or cuticle olive-brown and much wrinkled. The disks or pieces are generally concave on both sides, owing to the shrinking of the spongy interior part in drying. The best specimens of the root are those slices which are least worm-eaten, solid, and heavy.

Calumba root has a slight aromatic odour, and a simple bitter taste; it is brittle, breaks with a starchy fracture, and is easily powdered. Boiling water and alcohol and ether extract its virtues; but proof-spirit is its best menstruum. The infusion made with boiling water strikes a beautiful blue with tincture of iodine; and this is the test for distinguishing the true root from a *false Calumba*, which was sent, some years since, from the Barbary states†. The roots of an American plant, Swartzia *Frazeri*, have been also brought to this country, under the name of American Calumba: but its Infusion becomes dark green when tested with Sesqui-chloride of Iron, and yields no precipitate with Tincture of Galls. The aqueous infusion of true Calumba is precipitated by infusion of Galls, yellow Cinchona bark, Acetate of Lead, Bichloride of Mercury, and Lime-water; but not by Chloride of Barium, Sulphate of Iron, Nitrate of Silver, nor Tartrate of Antimony and Potassa. According to the chemical analysis of M. Planché, Calumba root contains—starch, about one-third of its weight; a yellow azotized matter; a bitter yellow principle, not precipitated by the metallic salts; traces of a volatile oil; woody

* Woodville's Med. Bot. 3rd edition, vol. v, p. 22. London Dispensatory, art. Calumba. Richard's Hist. Nat. Med. ii, 612. Berry's Asiat. Research. x, 285. Lindley, 369. Hayne, ix, 48.

† This false Calumba is further known by its white colour, lighter texture, and its taste, which is at first sweetish, and not half so bitter as that of the true Calumba. Its infusion also reddens the tincture of litmus; caustic potassa disengages ammonia from it; salts of iron precipitates its infusion black; and ether, digested on it, acquires a bright yellow colour; none of which effects are presented by these tests on the Infusion of true Calumba.

fibre; salts, consisting of bases of lime and of potassa; oxide of iron, and silex*. A new crystallized principle, *Calumbin*, has been procured from Calumba, by digesting the powdered root in ether, filtering and evaporating. It crystallizes in the form of rhombic prisms, which possess the bitter taste of the root; is soluble in alcohol, ether, volatile oils, diluted acids, and alkalies, but not in water: but its properties require examination. Its composition, according to Leibig, is 65·40 Carbon, + 6·18 Hydrogen, + 28·37 Oxygen, = 100; or C·12, H·7, O·4—equiv. = 112·44. Dr. Duncan supposed that Calumba root contains Cinchonia; and certainly the action of reagents on its aqueous decoction apparently accords with his opinion: but the examination of the root, by M. Planché and M. Guibourt, has not detected this principle in Calumba: and the precipitate formed by the Tincture of Galls is a tannate of starch. The central part, or pith, contains little or no bitter extractive; and should, therefore, be separated before making an infusion or decoction of the root.

The tonic properties of Calumba have been known since 1685: and, as it possesses no astringency, and is little stimulant, it is perhaps the best Tonic in phthisical cases. It has a considerable power in allaying the irritability of the stomach accompanying pregnancy and dyspepsia; and, occasionally, attending dentition. Dr. Denman recommended it in the low stage of puerperal fever: and, as a Tonic, in combination with rhubarb and sulphate of potassa, I have found it extremely useful in the mesenteric affections of infancy and childhood. The officinal preparations of Calumba are Infusion and Tincture: it is however, sometimes prescribed in the form of Powder, in doses of ℈i to ℈ii. According to the experiments of Dr. John Davy, when taken alone in the form of Powder, it is said to exert a purgative effect.

Infusion of Calumba. *Infusum Calumbæ*, L. E. *Infusum Colombæ*, D.—The London and Dublin Colleges order ʒv of the sliced root to be infused in Oi of *boiling* distilled water for two hours, and strained: the Edinburgh College orders ʒiv, coarsely powdered, to be triturated with a little cold water, and then Oi of cold water passed through it in the percolater. The cold water extracts the whole of the bitter, and leaves the starch untouched; hence it is preferable to boiling water. The dose is fʒi to fʒii.

Tincture of Calumba. *Tinctura Calumbæ*, L. E. *Tinctura Colombæ*, D.—This is a spirituous solution of the bitter principle: it is made with ʒiii of the powdered root and Oii of proof spirit. The Edinburgh College orders the percolater to be used in preparing it. Calumba is one of the few vegetable medicines which should be given in the form of tincture; the alcohol taking up the active principles only of the root. The dose of the tincture is from

* Bull. de Pharm. t. iii, p. 289.

f℥i to f℥iii, and even more if the patient have been accustomed to the use of ardent spirits.

COMMON AVENS. *Gei Urbani Radix,* D.—This is the rhizome of an indigenous plant, belonging to the natural order Rosaceæ*, growing very abundantly in woods and thickets, flowering in June, July, and August. The plant rises with an erect, branched, hairy stem. The radical leaves are in long footstalks, pinnate, and somewhat lyrate: the stem leaves ternate; with large, rounded, lobed, serrated, leafy stipules. The flowers are solitary, small, stalked, and of a bright yellow colour.

The rhizomes, which are the parts employed, should be dug up in spriug; they are about three inches long, and give issue to many cylindrical roots. The cortex is brownish, the interior of a pinkish-red hue. The roots have a fragrant odour, not unlike that of cloves; their taste is austere and bitter. In distillation they yield an aromatic oil in small quantity. According to the analysis of Melandri and Moretti, they contain resin, tannic and gallic acid, oxygenizable extractive, soapy extractive, chlorides of potassium and magnesia, nitrate of potassa, malate of lime, mucus, lignin, and volatile oil†. Tromsdorff, also, analyzed the roots of Geum, and procured tannin, resin, volatile oil, tragacanth, gummy matter, lignin, and a trace of sulphur‡.

Avens have Tonic properties. On the Continent, they are much used in intermittents; and in convalescences from acute diseases. Augsburg beer, which is considered as an excellent preventive of ague, in the fenny parts of Germany, owes its properties to the Geum Urbanum, a small bag of the bruised rhizome of which is put into the cask. The best mode of administering Avens is in powder; but it is also administered in the form of decoction, one ounce of the bruised root being boiled in one pint of water, and strained. The dose of this decoction is from f℥i to f℥iss, given three or four times in the day.

* * *Entire Plants.*

ICELAND MOSS. *Cetraria Islandica,* L. E. *Cetraria Islandica,* D.—This is a lichen, not a moss. It is found not only in Iceland and other parts within the Arctic circle, but on the mountains of central Europe, the Alps, and the Pyrenees, Jura, and many of the mountains in the northern parts of our Island. It grows in tufts, sometimes on the rocks and arid places, but not unfrequently on the pasturage on mountains. It holds a place among the *Cellulares,* in the order Lichenaceæ of the natural arrangement§. The thallus is harsh when dry; tough and flex-

* Woodville's Med. Bot. third edit. p. 502, pl. 181. London Dispensatory, art. Geum. Lindley, 226.

† Bulletin de Pharm. t ii, p. 358.

‡ Journ. de Pharm. t. v, p. 310.

§ Woodville's Med. Bot. third edition, p. 804, pl. 271. London Dispensatory, art. Lichen. Richard, Hist. Nat. Med. t. i, p. 282. Lindley, 627.

ible when moist; of a greyish-green colour, passing to chesnut brown on the edges, near four inches in height; and divided or branched into lobes and channelled laciniæ, with toothed extremities. When dry, it is easily pulverized. It absorbs its own weight of water when steeped in that fluid. It is as frequently employed as an article of diet for the convalescent, as a Tonic.

This Cetraria has no sensible odour, but a very bitter, somewhat astringent taste. It has been analyzed by several chemists: the analysis of Berzelius is that most to be depended on. He ascertained that it contained, in 100 parts—saccharine matter 3·6; bitter principle 3; bitartrate of potassa 1·9; green wax 1·6; extractive 7; gum 3·7; fecula 44·6; woody fibre 34·6. Its astringency is stated to depend on traces of tannic acid: this, however, is doubtful, as the salts of iron do not indicate it when added to the decoction. On the contrary, the sulphates of iron produce a reddish or port-wine colour with the decoction, which is probably owing to the action of the free tartaric acid of the bitartrate of potassa. The extractive is developed by chloride of tin; the gum by diacetate of lead; the lichenic acid by sesquichloride of iron, and the fecula by the tincture of iodine. It yields almost all its bitterness to cold water: boiling water takes up 65 per cent. of the weight of the lichen; and the decoction forms a mucilaginous jelly on cooling. Boiling alcohol extracts the bitter, and the colouring matter: alkalies extract its bitter principle. This principle has been examined by Herberger*. It is procured by boiling the lichen in four parts of alcohol, filtering the solution when warm; acidulating it with hydrochloric acid, and ultimately diluting with three volumes of water. The crystals, which slowly form, are purified by squeezing and washing them with ether. They are white, intensely bitter, insoluble in water, little soluble in alcohol at 60°, but soluble in boiling alcohol, in ether, and in the alkalies. Hydrochloric acid, moderately heated, colours them blue.

The tonic powers of Iceland lichen depend on the bitter principle; and, therefore, when it is employed as a Tonic, which has been the case for some years past, to a considerable extent, the bitter should not be wholly removed. Even when it is to be employed as nutriment, there is too much anxiety to remove the whole of the bitter; a small portion of it is requisite for aiding the digestion of the fecula. But, as the bitter is very nauseous to many palates, a part of it may be removed by boiling the lichen twice, and adding to the first boiling a small quantity of any alkaline carbonate. In this state, combined with milk, it forms an excellent article of diet in convalescence from the remittent fever of childhood, and in dentition.

Decoction of Iceland Moss, *Decoctum Cetrariæ*, L. made

* Journ. de Pharm. xxiii. p. 505.

by boiling ℥v of the lichen in Oiss to Oi and strained. The addition of five or six minims of diluted sulphuric acid, and f℈i of syrup of white poppies, to f℥iss of the decoction, affords an excellent Tonic in phthisis, and in cases of great emaciation from acute disease. In cases of chlorosis and imperfect menstruation, the decoction may be advantageously combined with the sulphate or the sesqui-chloride of iron, as in neither case the salts are precipitated.

* * *Inorganic Products.*

h. METALLIC PREPARATIONS.

IODIDES.

i. Iodide of Zinc.—This salt is made by boiling together thirty parts of pure Metallic Zinc and one hundred and twenty-six parts of Iodine, until the solution becomes colourless, then filtering and evaporating to dryness. It is a yellowish-white mass, very deliquescent, and rapidly decomposed. It is very soluble in water; but the solution cannot be preserved without keeping in it a plate of Metallic Zinc. The best mode of preparing it is in the form of thick syrup. The dose of the Iodine is two to three grains.

k. CHLORIDES.

Chloride of Barium. *Barii Chloridum.* L. *Barytæ Murias.* E. D.—In strict chemical language, this salt is a chloride. It is prepared, according to the London and the Edinburgh Colleges, by dissolving the carbonate in muriatic acid, diluted with three parts of water, and crystallizing the solution. But the Edinburgh and the Dublin order it, also, to be prepared from the Sulphate of Baryta; which is converted first into a Sulphuret by the aid of charcoal and heat; and the Sulphuret into the Chloride, by acting upon it with Hydrochloric Acid. The sulphur is carried off by the hydrogen of the acid, and the Chlorine combines with the Barium. The carbonate, however, is so cheap that the second process is unnecessary. The carbonate was first found native in 1783, by Dr. Withering, after whom it was named Witherite. Its crystals assume different forms: in general, they are in right rectangular prisms: they have neither taste nor odour. But it is seldom found crystallized, being generally in pale yellowish, somewhat radiated masses; its sp. gr. 4·8; and its solubility so low, that it requires 4304 of water at 60°, and 2304 at 212°, for its solution. It melts before the blow-pipe into a white enamel. Its composition is 77·9 of Baryta, + 22·1 Carbonic Acid, = 100·0, or 1 equiv. Baryta, + 1 Carbonic Acid, equiv. = 98·82.

The Chloride of Barium generally crystallizes in flat rectan-

gular plates, with bevelled edges occasionally on two of the angles: their sp. gr. is 2·82: they are permanent in the air, unless it is very dry, when they slightly effloresce: are colourless, transparent, and have a peculiar, bitter, pungent, nauseous taste. They decrepitate in heat, and fuse at a high temperature. They are soluble in two and a half times their weight of water at 60° Faht. and in their own weight at 212°; but quite insoluble in alcohol. According to Berzelius, this chloride consists of Ba. + Cl. + 2 H. equiv. 122·12. By some chemists it is still regarded as a Hydrochlorate; an opinion adopted by the Edinburgh and the Dublin Colleges. It is decomposed by alkaline phosphates, and sulphates which form insoluble phosphates, and sulphates that exert no influence on the animal body; and by the citric acid, which forms with the Baryta a flaky precipitate, that gradually assumes the character of a beautiful and brilliant vegetation, which is partially soluble and poisonous. This Chloride cannot be administered with any of these salts; nor with astringent vegetable infusions, insoluble tannates being formed. Its only officinal form is

SOLUTION OF CHLORIDE OF BARIUM, *Liquor Barii Chloridi*, L. *Solutio Muriatis Barytæ*, E. *Aquæ Muriatis Barytæ*, D. It is prepared by dissolving ℨi (one part, D.) of the salt in f℥i (three parts, D.) of distilled water.

In large doses, the Chloride of Barium is an acrid poison, destroying not only the powers of the stomach, but extending its action to the heart, rendering that organ insensible to the stimulus of the blood. As the salt is decomposed, and insoluble compounds are formed by sulphuric acid and the alkaline sulphates, the soluble phosphates and tannic acid; these are the proper antidotes in cases of poisoning by it. In moderate doses, it operates on the capillary system as a powerful, and, in strumous affections, a beneficial, Tonic. The dose of the solution is m. v to fℨi.

l. OXIDES.

PURE OXIDE OF ZINC, *Oxydum Zinci*, L. E. D.—This Oxide may be formed, as ordered in the Dublin College, by the combustion of the metal in the air. The metal fuses at 940°, and burns with a brilliant white flame, developing white fleecy flocculi, which is the Oxide. But the London and Edinburgh Colleges order it to be prepared by decomposing the Sulphate of Zinc in solution, by means of Sesqui-carbonate of Ammonia; a Sulphate of Ammonia and Carbonate of Zinc are the result; the latter of which is separated, washed, and calcined to drive off the Carbonic Acid. It is sometimes adulterated with Sulphate of Zinc and Chalk. The former is easily detected by dissolving the suspected Oxide in Nitric Acid, and testing with Nitrate of

Baryta; the latter is detected by forming a solution, and adding Ammonia, which dissolves the Oxide and leaves the Carbonate of Lime. The dose is gr. i to gr. viii.

m. METALLIC SALTS.

SULPHATE OF ZINC. *Zinci Sulphas.* L. E. D.—This is a compound of sulphuric acid with the protoxide of zinc, and a large proportion of water of crystallization. Sulphate of Zinc was first artificially made in the sixteenth century, by Henkel and Newmann, two German chemists, who prepared it from calamine and blende, nearly in the same manner as it is now manufactured in some places for commercial purposes. The sulphurets are roasted and thrown, whilst they are hot, into water, which is afterwards evaporated in leaden boilers, and then exposed in wooden cisterns to crystallize. In this process the sulphur is partly converted into sulphuric acid, which aids the metal to decompose the water, the oxygen of which changes it into an oxide, which, uniting with the sulphuric acid, forms the Sulphate. The Sulphate of commerce is unfit for the purposes of medicine; and, therefore, it is ordered to be formed by adding two pints of diluted Sulphuric Acid to five ounces of pure *Zinc*, in fragments; straining the solution after the effervescence is finished, and crystallizing. In this process the Oxide of Zinc is formed by the decomposition of the water; and, as the oxide is instantly combined with the acid, a fresh surface of Zinc is constantly exposed, which enables the process to proceed, until the whole of the metal is oxidized, and converted into the sulphate. Thirty-two grains of Zinc are sufficient to form eighty grains of the Sulphate, by decomposing nine of water, and combining with its oxygen to form forty grains of the Oxide, which require forty of the Acid to convert them into the anhydrous salt. The salt obtained is in its crystalline state.

Pure Sulphate of Zinc, although strictly neutral, yet is an acidulous salt; it has an acrid, styptic taste; is inodorous and in colourless, transparent, flattened, quadilateral crystals, which effloresce in the air; and are usually broken down in the sulphates of the shops. When exposed to heat, they first lose their water of crystallization, then their acid, and, if the temperature be much raised, the simple oxide remains. Sulphate of Zinc is soluble in two parts and a half of water at 60°, and in its own weight of boiling water. The solution is precipitated by alkaline carbonates; but the pure alkalies first precipitate and then redissolve the oxide: it is also precipitated by salts of baryta and acetate of lead; the precipitates being sulphates of baryta and of lead, whilst Chloride, Nitrate, or Acetate of Zinc remains in solution: these substances, therefore, are incompatible in prescriptions with Sulphate of Zinc.

With sulphate of potassa it forms a double salt, which crystallizes in flat, rhombic, prisms; a compound salt, extremely useful where a tonic influence is required to be conjoined with an aperient. The composition of Sulphate of Zinc, in its crystalline state, is (Z. + S. O. 3) + 7 aq.

Oxide of Zinc	32·585	or	1 eq.	= 40·3
Sulphuric Acid	30·965		1	= 40·1
Water . . .	36·450		1 prop.	= 63·0
	100·000		Equiv.	= 143·4

As a Tonic, Sulphate of Zinc exerts its primary influence on the stomach: the effect produced there being communicated by nervous sympathy to the rest of the system. It is supposed to operate with less general excitement than other metallic salts, and, therefore, it is frequently prescribed in phthisis. To its general tonic influence, also, may be ascribed its efficacy in the humid asthma of old men; for, by communicating tone to the exhalant bronchial vessels, it diminishes both the acrimony and the quantity of the bronchial excretion, and renders the expectoration more easy.

The dose of the Sulphate of Zinc, when its tonic influence only is desired, should not exceed gr. ii, repeated twice or three times a day. It may be given in combination with all the mineral acids: and also with the pure alkalies in excess; and with such of the bitter infusions as contain little tannic acid.

Acetate of Zinc. *Zinci Acetas.* D.—This salt may be prepared by the direct combination of its constituents; but it is usually directed to be obtained by mixing the solution of the acetate of lead with a solution of sulphate of Zinc; a double decomposition takes place, the oxide of zinc detaches itself from the sulphuric acid and combines with the acetic, leaving the lead in union with the sulphuric acid, as an insoluble sulphate, which precipitates. By filtering and evaporating the liquid, the Acetate of Zinc is procured in talc-like crystals, soluble in water, and readily decomposed by heat. The constituents of this salt are (Zn. + Ac.) + 7 aq. or 1 oxide of zinc = 40·3, + 1 acetic acid = 51·48 + 7 water (7 + 9) = 63, equiv. = 154·78.

Acetate of Zinc possesses the same tonic properties as the sulphate. It is seldom prescribed as an internal remedy; but frequently as an astringent collyrium in ophthalmia. The Dublin College orders it in the form of tincture.

Tincture of Acetate of Zinc. *Zinci Acetatis Tinctura.* D.—This is made by macerating equal parts of the Sulphate of Zinc and Acetate of Lead in sixteen parts of proof spirit, for a week, and filtering. It possesses no advantages over the aqueous solution of the Acetate.

Sulphate of Copper. *Cupri Sulphas.* L. E. D.—This salt

is found abundantly in a state of nature, occasionally solid, massive, or in capillary or cubic crystals, but more generally in solution in water, in the vicinity of copper mines. It is also obtained by roasting the native sulphurets of copper, and treating them in the same manner as the sulphurets of zinc for the preparation of the sulphate of that metal. It is known in commerce by the names of *blue vitriol*, or *blue copperas*, and is a bisulphate.

This salt is usually in the form of oblique rhombic crystals, varying according to the manner in which the process is conducted. Sulphate of Copper is inodorous, and has a strong styptic taste. It is soluble in four parts of water at 60° Faht. and in two parts of boiling water. It is soluble in alcohol. When long exposed to the atmosphere, it undergoes slight efflorescence, so that its surface becomes covered with a whitish-green powder. In a moderate heat, it dissolves in its water of crystallization, and in a high temperature is decomposed, the acid is driven off, and the brown oxide of copper remains behind. According to the analysis of Berzelius, the pure sulphate consists of—(Cu. + S.) + 5 aq. or Sulphuric Acid 31·57, + Oxide of Copper 32·13, + Water 36·30, = 100·00; or C. 4O. + SO. 3, × HO. equiv. = 124·7.

Sulphate of Copper is decomposed by alkaline solutions; by lime water; the hydrosulphurets; liquor potassæ; sulphuretted hydrogen, and biborate and phosphate of soda; the salts of lead; chloride of barium and acetate of baryta; the nitrates of lime, mercury, and silver; and astringent vegetable decoctions and infusions. It is also precipitated, copiously, of a reddish-yellow colour, by ferro-cyanate of potassa.

Sulphate of Copper is a powerful, but hazardous Tonic. It has been given in doses of from one-sixth of a grain to one grain in spasmodic diseases, in combination with opium, twice or three times a day: but, unless the disease be accompanied with severe diarrhœa—as, for instance, Asiatic cholera, in which it has proved successful—it is not to be recommended. In chronic diarrhœa, nothing is more likely to check the discharge and to increase the tone of the habit than Sulphate of Copper, in doses of gr. ss, combined with gr. i or gr. ii of opium. It has been supposed to operate in these cases by its astringent powers; but the dose is too minute to support this opinion; and it is more probable that it acts by increasing the tone of the intestinal nerves. The dose of the Sulphate, as a Tonic, may be gradually extended from g. ss to gr. ii; but it ought not to exceed this quantity, unless it is intended to operate as an emetic.

Diacetate of Copper. *Ærugo.* L. E. *Cupri Acetas, Cupri Subacetas*, D. Syn. *Verdigris. Distilled Verdigris.*

The first of these substances is prepared at Montpellier in

France*, by stratifying plates of copper with the fermenting marc of grapes from the wine presses; the copper is thus first formed into an oxide, and then, uniting with the acetic acid of the husks and stalks, forms a mass of impure acetates of copper. It is also prepared at Grenoble, by simply moistening copper-plates with distilled vinegar, and, in England, with pyroligneous acid. This preparation is usually obtained in a dry, hard, pulverulent, foliaceous, pea-green mass. It has an acetous odour, and a nauseous, styptic, coppery taste. It is permanent in the air. Distilled water dissolves 0·56 parts only of the crude Verdigris, which consist of soluble Sesquiacetate of Copper, composed of $1\frac{1}{2}$ eq. oxide of copper $=$ 58·11 + 2 acetic acid (51·41 $\times$ 2) $=$ 102·96, equiv. $=$ 161·07: the insoluble portion is a diacetate, and consists of 2 eq. of oxide $=$ 79·2, + 1 of acid $=$ 51·48, equiv. $=$ 130·68.

ACETATE OF COPPER, *Cupri Acetas*, D. formed by dissolving Verdigris in diluted pyroligneous acid, decanting off the solution and crystallizing by evaporation. It is obtained in very deep-green rhomboidal crystals, efflorescent in the air, and, when exposed to it, becoming of a light bluish-green hue; they are entirely soluble in water, but not in alcohol or ether. They are the principal ingredients in the blue variety of Verdigris. The composition is $\bar{A}$ + Cu. O. + H. O. $=$ eq. 100·08.

AMMONIO-SULPHATE OF COPPER. *Cupri Ammonio Sulphas*. L. *Cuprum Ammoniatum*. E. D.

These salts of copper possess the same poisonous and tonic powers as the sulphate. When any salt of copper has been taken in poisonous doses, violent vomitings and pains of the stomach and intestines follow: there is a distinct coppery taste in the mouth, and a sensation of strangulation in the throat, colic pains, sometimes purging, with severe tenesmus, and occasionally the alvine discharges are bloody: these symptoms are followed by violent headache, vertigo, cramps, and convulsions; and, if the poison be not wholly expelled from the stomach, inflammation of the mucous membrane supervenes, and death rapidly follows. To relieve these symptoms, the stomach must be emptied by means of the stomach pump, and the excitement reduced by bleeding. Orfila and others advise to give as much albumen and *sugar* as the patient can swallow. The sugar and albumen, in this case, are supposed to reduce the salts of copper; but this is doubtful: they may alter them so much, however, that they lose their poisonous qualities. If sulphate of copper be boiled in a solution of sugar, it is reduced to the metallic state; but it requires to be boiled. These substances, however, are usually employed in cases of poisoning by salts of copper.

TRISNITRATE OF BISMUTH. *Bismuthi Trisnitras*. L. *Bis-*

* London Dispensatory, 6th edition, art. Cuprum.

muthum album. E. *Bismuthi subnitras.* D.—This Tonic salt is a compound of the Oxide of Bismuth, water, and nitric acid. It is never found in a natural state. Bismuth dissolves readily in nitric acid moderately diluted with water; and when this solution is poured into a large quantity of water, a snow-white precipitate subsides, which, separated by the filter, washed and dried, is Trisnitrate of Bismuth. It is a white, inodorous, tasteless, flaky substance, soluble in the acids and the pure alkalies. It is blackened by light, if it contain silver; and, when pure, by sulphuretted hydrogen and its compounds. It consists of 3 eq. of Oxide of Bismuth $(79 \times 3) = 237$, $+$ 1 nitric acid, $=$ 54·15, equiv. 291·15 (3 Bi. O. + N. O. 3).

This preparation is a powerful Tonic, particularly useful in that state of the stomach which produces *pyrosis*. The Trisnitrate, in doses of from gr. iii to gr. x, in combination with gr. i of opium, gives almost immediate relief, and affords a more decisive evidence of the primary action of tonics on the stomach than any medicine of this class.

2. *Operating through the medium of the Blood.*

* *Organic Products.*

Leaves.

a. BUCKBEAN, *Menyanthes*, L. E. D. or Marsh-trefoil, Menyanthes *trifoliata*, is an indigenous plant, belonging to the natural order *Gentianaceæ**. It is found in moist and boggy meadows and ditches over the greater part of Europe and in North America. It throws up ternate leaves, on long petioles, from the end of an articulated, horizontal rhizome. The leaflets are oval, smooth, somewhat fleshy, with broad sheathing stipules at the base of the footstalk. The flowers, which blow in June, are in a conical, erect raceme, on a smooth, round, ascending scape. The corolla is white, and clothed on its upper disk with dense, fleshy, obtuse, pink hairs. It is one of the most beautiful of our indigenous aquatics.

The whole plant is bitter, and slightly astringent, but destitute of odour. Tromsdorff found in it 25 parts in 100 of solid matter, consisting of *bitter extractive*, *chlorophylle*, a *peculiar matter*, which was precipitated from its aqueous solution by Tannic acid, *brown gum*, *fecula*, *inulin*, *malic acid*, and *acetate of potassa*†: but it also contains *tannic acid.* The infusion strikes a deep black with persulphate of iron, shewing the presence of gallic acid; throws down a copious precipitate with alum and protochloride

* Woodville's Med. Bot. third edit. p. 177, pl 97. London Dispensatory, art. Menyanthes. Richard, Hist. Nat. Med. t. ii, p. 132. Lindley, 523. Hayne, iii, 14.

† Ann. de Chim. et Phys. t. lxxii, p. 191.

of tin; and also precipitates infusion of yellow cinchona bark. It is acted upon by chlorine, which separates the extractive, rendering it insoluble.

Buck-bean or Marsh Trefoil is an admirable Tonic, and would be much prized, if it were less common. It is administered in the form of powder, or an infusion made with ℥ss of the dried herb and Oi of boiling water. In large doses, the infusion excites vomiting; and, under certain conditions of the body, notwithstanding its astringency, it purges or acts as a diuretic, according as the surface is more or less exposed to cool air. It may be given in powder, in doses of from ℈i to ʒi; and f℥i to f℥iss of the infusion, prepared with ℥i of the herb to Oi of boiling distilled water. On account of its nauseating properties, it is useful to combine it with aromatics. It is incompatible with the Salts of Iron.

b. LEAVES OF BEAR'S WORTLEBERRY. *Uva Ursi.* L. E. D.— These are the leaves of Arctostaphylos *Uva Ursi*, an indigenous plant, a native of most of the mountainous districts of Europe. It belongs to the natural order Ericaceæ*. Like its congeners, it is an evergreen shrub, low, and trailing on the ground. Its leaves are obvate, nearly obtuse, firm, and glossy, of a deep green on the upper disk, and paler on the under. Their entire edge, and their thick, firm texture, distinguish them from those of the Vaccinium *Vitis Idea*, Cowberry, with which they are often mixed. They are reticulated; but the leaves of Vaccinium are dotted on the under disk, and thus readily distinguished. They have no sensible odour; their taste is extremely acerb and astringent. When triturated with cold water, the infusion strikes a beautiful deep blue with persulphate of iron, from the large portion of tannic acid which they contain.

According to the analysis of Meissner, their constituents are 1·2 of *Gallic Acid;* 36·4 *Tannic Acid;* 4·4 *Resin;* 0·8 *Oxidized Extractive with Citrate of Lime;* 3·3 *Gum with Chloride of Sodium and Supermalates of Lime and Soda;* 15·7 *Pectic Acid;* 17·6 *Extractive;* 6·3 *Chlorophylle, and* 16·9 *Lignin, Water and loss* 100·00. The Tannic Acid is the active principle of the leaves.

Uva Ursi possesses tonic powers; and has been employed in convalescence from diarrhœas, and in leucorrhœa. It displays considerable action on the urinary organs. It has been recommended by Dr. Bourne in phthisis pulmonalis; but the remedy has not succeeded in the hands of other practitioners. He combined ten grains of the powder of the leaves of the plant with fifteen grains of cinchona bark and half a grain of opium, and gave this mixture three times a day. The effect was to lower the pulse without adding to its force: and to palliate the sym-

* Woodville's Medical Botany, third edit. p 288. pl. 100. London Dispensatory, art. Uva Ursi. Richard, Hist. Nat. Med. t. ii, p. 167. Lindley, 382. Hayne, x, 40.

ptoms, Uva Ursi may be given in the form of Decoction and Extract; the powder is preferable when the tonic influence of the leaves is required. The dose of the powder is from ten grains to half a drachm.

DECOCTION OF UVA URSI, *Decoctum Uvæ Ursi*, L. is made with ℥i of the bruised leaves and Oiss of distilled water boiled down to Oi and strained. The dose is f℥i to f℥iii. It possesses no advantage over the cold infusion.

EXTRACT OF UVA URSI. *Extractum Uvæ Ursi.* L.—Prepared by evaporating the Decoction. The dose is gr. v to gr. xv.

c. LEAVES OF THE BLESSED THISTLE. *Cnici Benedicti Folia.* D.—Cnicus *Benedictus* is a native of Spain and the South of Europe, belonging to the section Cynaraceæ, of the natural order Compositæ*. It is an annual, with amplexicaul, somewhat decurrent, deeply pinnatified, hairy leaves; with the flowers in a bracteate head, and yellow florets. The leaves, which are the officinal part, have scarcely any odour, but an intensely bitter taste. They have been analyzed by M. Morin, of Rouen, and found to contain—*a bitter principle*, more soluble in hot than in cold water, and very soluble in alcohol and ether; a *resinous substance;* a *green fatty matter;* *liquid sugar;* *gum;* a *volatile oil;* *nitrate of potassa;* *malate of lime;* several *mineral salts;* some *oxides;* and *traces of sulphur*. This analysis throws no light on the active principle of the plant.

The infusion of Cnicus *benedictus* acts powerfully upon the stomach, and, in large doses, operates as an emetic, and sometimes purges. In small doses, its influence is directly tonic; and this is accompanied with a marked action on the cutaneous capillaries. The infusion for tonic purposes may be made with ℥ss of the dried plant in Oi of boiling water; it may be taken to the extent of a small cupful, three times a day, with advantage; or from ten grains to half a drachm of the powdered leaves may be given in wine. On the Continent, where this Tonic is more frequently employed than in this country, both the powder and the infusion are ordered. The dose of the infusion is a fluid ounce and a half twice or three times a day.

* * *Inorganic Substances.*

METALLIC PREPARATIONS.

a. IODIDES.

IODIDE OF IRON. *Ferri Iodidum.* E. L.—This is a combination of Iron and Iodine, and by proper precautions it may be procured in the solid state; but, owing to its deliquescent character and its proneness to undergo decomposition, it is pre-

* Woodville's Med. Bot. third edition, p. 34, pl. 14. London Dispensatory, art. Centauria. Richard, Hist. Nat. Med. t. ii, p. 430. Lindley, 468. Hayne, vii, 34.

ferable to keep it in the state of solution or of syrup. The solution is readily prepared by boiling together dry pure Iodine and clean soft iron wire in the proportion of 56 or 60 parts of the Iron to 252 of the Iodine. As the union of the two substances takes place, the fluid changes from a dark reddish-brown to a pale green colour; or it becomes nearly colourless. When this solution is evaporated to one sixth of its volume, as ordered by the Edinburgh College, then filtered, and put into an evaporating basin, with twelve times its weight of quick-lime around the basin, and being shut up within a box without any communication with the air, and placed in a hot-press until the whole of the water is evaporated, the Iodide is procured of a greyish-black metallic appearance and irregularly foliated texture. In this state, when newly made, it dissolves without any residue in boiling water; but, after a short time, however carefully kept, it always displays free Iodine in the solution, and precipitates sesquioxide of iron as a residue. It is always preferable, therefore, to keep it in solution of a definite strength, with a coil of Iron wire in it, which gives fresh portions of Iron to the Iodine, as quickly as that in solution is converted into the sesquioxide. By this means the solution remains of the same strength as at first; and no free Iodine is present. The solid salt has a strong styptic taste. When exposed to heat, it is decomposed; the Iodine escapes in the form of violet vapour, and sesquioxide of Iron remains. The salt, when the evaporation is over quicklime, in the vacuum of an air-pump, is procured in large, tabular, greenish, transparent crystals. The constituents of the Anhydrous Salt is 1 equiv. of Iodine = 126·3, + 1 Iron = 28 equiv. = 154·3: the crystallized contains five equivalents of water (Fe. I. + 5 H. O.) eq. 199·3. The best strength for the solution is three grains in a fluid drachm; and this may be kept for any length of time, without decomposition, by forming it into a syrup.

The Iodide of Iron was introduced into medical practice by the author of this work, and is now generally used in this country. It is Tonic and deobstruent; and influences the habit by its absorption into the blood, as both the Iodine and the Iron can be detected in the urine soon after a dose of it has been swallowed. Dr. Christison doubts whether the influence of the Iodine is felt on the habit; but I have, as yet, seen no reason for altering my opinion that both the Iron and the Iodine conjointly operate when this salt is administered.

The Iodide cannot be prescribed in the solid form, and in solution its facility of decomposition is so great, that it scarcely admits of combination.

Syrup of Iodide of Iron, *Ferri Iodidi Syrupus*. E. is made with gr. 200 of Iodine, gr. 100 Iron Wire, recently cleaned, and distilled water f℥vi, boiled together until the fluid

be reduced to f℥ii. This is to be filtered whilst it is hot, and ℥iv of white sugar in powder added to make the Syrup. When the syrup is well made and strong, it may be crystallized, like sugar candy, without affecting the Iodide. The formula of the Edinburgh College, which is a modification of one which I suggested*, contains too little sugar. The syrup remains entire, in conjunction with substances that instantly decompose the solution: when dried, it may be administered in the form of pills. The only officinal preparations are the Iodide in the solid form, and the syrup.

The dose of solid Iodide is gr. i to gr. v; that of the Syrup, m. xv to ʒi.

b. CHLORIDES.

CHLORIDE OF CALCIUM. *Calcii Chloridum.* L. *Calcis Murias.* E. D.—This is a combination of Chlorine and Calcium. It can be readily procured by the action of diluted Hydrochloric Acid on chalk, as ordered by the London College, or on white marble, as ordered by the Edinburgh: or it may be obtained by digesting the residue of the operation for the production of liquor ammoniæ, filtering and evaporated to dryness, as ordered by the Dublin College. It crystallizes in long six-sided prisms, terminated by hexædral prisms. Its taste is acrid, sharp, bitter, and very disagreeable. It is inodorous; extremely deliquescent; and, when fused in a high temperature, is not decomposed. It requires to be kept in well-stopped bottles.

Chloride of Calcium consists of—

Calcium	1 eq.	=	20·5	or	35·71
Chlorine	1 eq.	=	35·42		64·39
	Equivalent		55·92		100·00

or, when crystallized, of Ca. + Cl. + 5, eq. = 100·92.

As a medicinal agent, Chloride of Calcium is a Tonic of some power. It is taken into the circulation, and its effects undoubtedly depends on its tonic influence. It is said to have succeeded in bronchocele when iodine failed†. Its use in that disease was first suggested by Fourcroy, in 1782; and, afterwards, its powers were investigated by Dr. Beddoes and Dr. Pearson; and my own experience has enabled me to recommend it with confidence. It can be combined with the Tincture of Hydrochlorate of Iron; it is advantageously prescribed with that salt, in languid states of the female habit, with a tendency to bronchocele or other glandular swellings. I have advantageously applied the iodine ointment externally, whilst the patient was taking the Chloride of Calcium. It may be administered, also, in conjunction with *pure* ammonia. It cannot be combined in prescriptions with the protosulphate of iron, or

* Pharm. Journ. and Trans. vol. i, p. 44. † Med. Rep. vol. ii, p. 383, New Series.

the carbonates of the alkalies: in the one case an insoluble sulphate of lime, in the other a carbonate of lime, is formed; both of which are useless. In large doses it excites nausea and vomiting; and this sometimes follows small doses. This effect is relieved by opium. Lisfranc asserts that he has found it highly serviceable as an ointment in ulcerated chilblains*.

Solution of Chloride of Calcium. *Liquor Calcii Chloridi.* L. *Calcis Muriatis solutio.* E. *Calcis Muriatis Aqua.* D. This solution differs in strength in the Pharmacopœias—the London orders ℥iv of the Chloride to f℥xii of distilled water; the Edinburgh, ℥viii to f℥xii of water; the Dublin, three parts to seven of water. The dose is from m. xx to fʒi, in the infusion of any simple bitter.

Chloride of Sodium. *Sodii Chloridum.* L. *Sodæ Murias.* E. D. *Sodæ Murias purum.* D.—This important salt is found abundantly in various parts of the world: in France, in Switzerland, the Tyrol, Hungary, Transylvania, and very extensively in Cheshire. In Spain, near Cordova, there is a mountain of common salt, 500 feet in height and nearly three miles in circumference. In the springs of Saltzhauzen in Silesia, of Kissengen in Bavaria, and of Droitwich, Middlewich, and other places in England, it abounds in such quantity that it is profitably extracted from them. The diffusion of this salt, indeed, is a wise provision of Providence, as it is essential for the health of both vegetables and animals; exciting the energy of the living system of both, when taken in small quantities; and increasing the vascular action and vigour of the frame: when swallowed in large doses it proves emetic; and, in medium doses, purgative.

To do justice to the natural history, chemical properties, and therapeutical virtues of common salt, would require more space than can be spared in this work: I will, therefore, confine my remarks to a brief sketch of its chemical properties, and an account of its practical use as a Tonic.

Chloride of Sodium, in its purest state, is in white, semitransparent, regular cubical crystals, very slightly deliquescent when exposed to damp air. It is inodorous, with a taste purely saline, and perfectly free from bitterness. When thrown upon a heated iron plate, it decrepitates, in a greater heat it *melts*, and in very high temperatures it is volatilized *unaltered*. It is equally soluble in cold and in hot water, requiring two parts and a half only of its weight of that fluid for its solution. Its solution continues unaltered till it arrive at a temperature under 28°, when the salt separates from the water in which it is dissolved: hence ice taken up at sea yields fresh water. It is sparingly soluble in rectified, but not at all in absolute alcohol. It is

* See Revue Med. Feb. 1826.

decomposed by nitric and sulphuric acids, and nitrate of silver. The constituents of this Chloride are, according to Berzelius—(Na + Cl.)

Chlorine . .	59·305	or	1 eq.	= 35·45
Sodium . .	40·695		1	= 23·3
	100·000		Equiv.	58·75

As a Tonic, although its powers are daily and hourly before our eyes, in its effects when taken with food or as a condiment, yet Chloride of Sodium is seldom prescribed as an officinal Tonic. In many states of the animal body there is a strong instinctive desire for salt, and this is powerfully exemplified in the habit of quadrupeds who come from the interior of the Continent of America, where there is no salt on the surface, to the sea-shore to procure it. When food contains no salt, the body becomes cachectic, and falls into a disease resembling sea scurvy, which soon disappears if salt be administered. When an instinctive desire for salt occurs in delicate children, the greatest benefit is derived from the employment of Chloride of Sodium as a Tonic; and I am induced to ascribe its value as an anthelmintic, or destroyer of intestinal worms, rather to its influence as a Tonic than to any other power it possesses. The best method of prescribing it, in such cases, is to mix from gr. x to ℈i in a glass of port wine, and to administer this mixture daily at noon. As a local Tonic, the solution of sea-salt is a useful application to old and indolent ulcers: the strength should be proportionate to the degree of stimulus which the sore requires. Its tonic influence on the skin shall be noticed in treating of the tonic effects of cold-bathing.

Ammonio-chloride of Iron, *Ferri Ammonio-chloridum*, L. is prepared by digesting three ounces of Sesqui-oxide of Iron in half a pint of Hydrochloric Acid on a sand bath for two hours, then adding lb. iiss of the Hydrochlorate of Ammonia, dissolved in Oiii of water; filtering and evaporating to dryness. This is not, as its name implies, a double chloride; but it is, probably, merely a mixture of the Hydrochlorate of Iron and of Ammonia. It is of a yellowish colour, is inodorous, but has a strong chalybeate taste. It is readily soluble both in water and in proof spirit. When Liquor Potassæ or Lime Water is added to its solution, sesqui-oxide of Iron is precipitated and Ammonia evolved. According to Mr. Phillips, it contains 15 parts of Sesqui-chloride of Iron, + 85 Hydrochlorate of Ammonia, = 100*.

Tincture of Ammonio-chloride of Iron, *Tinctura Ferri Ammonio-chloridi*, L. is a filtered solution of ℥iv of the Ammonio-chloride in a pint of Proof Spirit.

* Trans. of London Pharm. p. 224.

The Ammonio-chloride of Iron is a very weak Tonic. It is sometimes given, in combination with Extract of Gentian, in the form of pills; but, more frequently, the Tincture is prescribed in doses of m. xx to fʒi. The dose of the solid preparation is gr. iii to gr. xv.

TINCTURE OF SESQUICHLORIDE OF IRON. *Tinctura Ferri Sesquichloridi.* L. *Ferri Muriatis Tinctura.* E. *Muriatis Ferri Liquor.* D.—The salt of Iron in this preparation is a sesquichloride, which crystallizes with difficulty, and deliquesces on exposure to the air. The Tincture is prepared by digesting for three days ℥vi of the Sesquioxide of Iron in Oi of Hydrochloric Acid, then adding Oiii of Rectified Spirit, digesting for three days; and, afterwards, filtering. The Dublin College orders one part of the Rust with six parts of acid and six of spirit. They form a permanent reddish-brown tincture, which has a strong styptic taste; and, owing to the superabundance of acid ordered in the preparation, the alcohol forms an imperfect hydrochloric ether, and has an etherial odour. Each drachm of the Tincture contains about four grains of the Sesquichloride; and a portion of the acid remains undecomposed. It has a reddish-brown colour, an etherial odour, and a strong subacid, astringent taste. Ammonia precipitates the sesquichloride in yellow flakes. With astringent vegetable infusions and decoctions, it forms an ink; and with the solution of the Ferrocyanate of Potassa, Prussian blue is precipitated.

It possesses the same tonic properties as the other preparations of Iron in an eminent degree. The best vehicle for its administration is simple water. The dose is from m. x to fʒss.

c. CYANIDES.

FERRO-SESQUICYANIDE OF IRON. *Ferri Percyanidum.* L. *Ferri Cyanuretum.* D.—This preparation, the Prussian blue of commerce, is prepared in the large way by fusing animal matter with Carbonate of Potassa, and treating the solution, which is a cyanide of Potassium, with Sulphate of Iron and Alum. It is an impure preparation, and requires to be purified by digesting it in dilute Sulphuric Acid before it can be employed for medicinal purposes.

It is of a deep indigo-blue colour, insoluble, inodorous, and tasteless. It is decomposed by the strong acids; and is supposed to be a compound of 3 eq. of Cyanide of Iron + 2 of Sesquicyanide of Iron ($3\ Fe.\ Cy. + 2\ Fe.^2\ Cy.^3$) equiv. = 433·51*.

Prussian Blue is not used in this country as a Tonic; but, in Germany and the United States of America, it is employed, in doses of a grain, as a Tonic and Antiperiodic, in remittent and

* Berzelius.

intermittent fevers. I have had no experience of its value; and, from the opinion of its inertness given by Coulon, I am doubtful whether it exerts any physiological influence on the living habit.

OXIDES.

The metals are capable of combining with oxygen in more than one proportion: hence the terms *protoxide*, *deutoxide*, and *peroxide*, and *acid*. The oxygen gives the efficiency to the preparation; for pure metals are inert. It also renders the resulting compound soluble in the animal fluids, and enables it to enter into the circulation, and be there decomposed, or to exert a primary influence on the nerves of the part to which it is applied. In both cases it operates as a Tonic.

QUICK LIME. *Calx*. L. E. D. SLAKED LIME. *Calcis Hydras*. L.—This is a compound of calcium and oxygen, artificially procured: for it is only found in combination with acids, forming mineral salts. It also forms a part of many vegetable and almost all animal bodies; constituting the solid part of the bones, teeth, shells, crusts, horns, nails, hair and feathers, in muscles, and even in the medullary part of the brain. When calcareous spars, carrara marble, chalk and limestones, are exposed to a red heat, carbonic acid is expelled, and pure Lime remains.

Lime, thus procured, is of a greyish-white colour, moderately hard, brittle, and porous. Its sp. gr. is 2·3. It has been ascertained to be a compound of Calcium 71·42, + Oxygen 28·58, = 100·00; or 1 eq. of Calcium, = 20·5, + 1 of Oxygen = 8, equiv. 28·5 (Ca. + O.) It is therefore a protoxide of the metal. It is inodorous, extremely acrid to the taste, displays distinct alkaline properties, and, when applied to the living body, enters into chemical union with its components, and corrodes and destroys the vitality of the part. It is one of the most infusible of known bodies, and has a powerful affinity for water. When newly burnt, water causes it to swell, become hot, and fall into powder; a large portion of the water is converted into vapour, whilst the rest disappears, having become an integrant part of the Lime, which has acquired weight, and is now a *Hydrate of Lime*, or a compound of Lime and condensed water. When the operation is performed on large quantities of Lime in a dark place, light as well as heat is given out. Hydrate of Lime, or slacked Lime, is a compound of Lime 75·68, + Water 24·32, = 100·00, Ca. O. + Aq. equiv. = 37·5. In this state it is soluble in water; and it is a curious fact, that cold water dissolves more of it than hot water. One pint of water at 32° Faht. dissolves eleven grains of pure slacked Lime; at 60°, 9·7 grains; and at 212°, 5·6 grains only. It is in solution that Lime produces a tonic effect when taken into the stomach.

Lime Water. *Calcis Liquor.* L. *Calcis Aqua.* E. D.—The solution of Lime, *Lime Water*, is prepared, according to the London College, by agitating half a pound of slacked Lime in twelve pints of water; then setting the mixture aside in a well-stopped bottle until the undissolved Lime subside, and carefully decanting the clear fluid. Lime Water is limpid, inodorous, and has an alkaline, harsh, but sweetish taste. It converts vegetable blues to green; unites with oil, forming an imperfect soap; and, when exposed to the air, rapidly absorbs carbonic acid, and is converted into Carbonate of Lime. It precipitates many of the astringent vegetable infusions and decoctions, is precipitated by oxalates, citrates, and tartrates, by the alkaline carbonates and borates, and by almost all the metallic salts. These substances, therefore, are incompatible in prescriptions with Lime Water. But although Lime Water is precipitated by carbonic acid and substances yielding it, yet, Carbonate of Lime is soluble in an excess of carbonic acid. For the same reason, although sulphuric acid precipitates lime from a strong solution, yet, in a dilute solution, no precipitation is produced. The old custom of combining bark with Lime Water was founded on erroneous principles; and it is questionable whether the combination of Lime Water with sarsaparilla be consistent with sound practice.

Lime Water is a Tonic of very moderate power; and it is probable that even this is due to its exerting a sedative influence on the nerves of the stomach, by which the irritability of the viscus is allayed; and the gastric juice, being more slowly secreted, is consequently more perfectly formed, and chymification thus aided.

Black Oxide of Iron. *Ferri Oxydum Nigrum.* E. D. Syn. *Æthiops Martialis.*—There are two Oxides of Iron—a protoxide (Fe. + O), consisting of 1 eq. of iron, = 28, 1 + of oxygen, = 8, equivalent = 36; and a sesqui-oxide (Fe. + $\frac{1}{2}$O.), consisting of 1 of Iron = 28, + $1\frac{1}{2}$ of Oxygen, = 12, equivalent = 40.

The substance under consideration is a mixture of both these oxides, united in irregular proportion. It is formed when iron is heated to redness in the air, as in the operations of the anvil, and when it is brought into contact with aqueous vapour at a high temperature. The small scales from the anvil are ordered, in the Dublin Pharmacopœia, to be separated by the magnet and powdered. The Edinburgh College orders its black oxide to be prepared by dissolving ℥iii of Sulphate of Iron in Oiss of boiling water, then adding eight fluid scruples of Sulphuric Acid; boiling, and, lastly, ʒivss of Nitric Acid, stirring assiduously after each addition. This solution is then to be mixed with a solution of three ounces of Sulphate of Iron in Oiss of water; and, after the two solutions are thoroughly

mixed, f℥ivss of strong Liquor Ammoniæ is to be added in a full stream. The Oxide is directly thrown down, and must be washed until the washings cease to be precipitated by Nitrate of Baryta. It must then be dried in a temperature not exceeding 180°.

The Black Oxide, in whatever manner it is prepared, is a black powder which soils the hands; and is insoluble in water, but soluble in acids, without exciting effervescence. The reason why the Dublin preparation is an irregular, mixed oxide, has been thus explained by M. Mosander. A bar of iron, when heated in the air, affords a layer of oxide on the surface, which contains more oxygen than the layer beneath it; the inner layer is always variable in its composition, the outer is generally uniform: the former consists of 2 eq. Protoxide = 72 + 1 Sesqui-oxide = 40, equiv. = 112: the latter of 3 Protoxide = 108, + 1 Sesqui-oxide, = 40, equiv. = 148. When pure, it is completely soluble in hydrochloric acid. According to Wohler, the Black Oxide formed from the sulphate is a compound of 2 eq. Protoxide, + 1 Sesqui-oxide, + 2 water, equiv. = 170 (2 Fe. O. + $Fe.^2$ $O.^3$, + H. O.). When it is heated in close vessels, the water is given off.

As a Tonic, the mixed Oxide was at one time highly extolled; at another, altogether neglected. In the state of a protoxide, Iron dissolves in the gastric juice, acts upon the nerves of the stomach, and through them upon the general system. The influence of this Oxide as a Tonic is less quickly obvious than that of the saline preparations of Iron; therefore it is well adapted for the treatment of those cases of general debility in which the tonic effect is not required to be quickly produced, but to be permanent. It is a better preparation than the filings of iron, which gain their activity from meeting with acid in the stomach; hence the inconvenience that follows their use, the oxidizement of the metal in the stomach producing a decomposition of the water of its aqueous contents, and the evolution of much hydrogen gas. The utility of the Black Oxide is, also, increased by its meeting with acid in the stomach, so as to favour its solution, and consequently its absorption into the circulating mass. Its operation is characterized by the black colour of the alvine discharges. The dose of the Black Oxide is from gr. v to ℈i: it may be combined with any aromatic.

Sesquioxide of Iron. *Ferri Sesquioxidum.* L. *Ferri Oxidum rubrum.* E. D. *Ferri Carbonas.* D.—The preparation to which these names are attached in the Pharmacopœias is a Sesquioxide of Iron. It is formed by decomposing four parts of the Sulphate of Iron in solution with nearly five parts of Carbonate of Soda, washing and drying the precipitate. The carbonic acid is driven off as the protoxide attracts oxygen from the air, and is converted into the sesquioxide. It was supposed

at one time to be a carbonate, the same as found in many mineral waters, held in solution by an excess of carbonic acid: but oxygen is so rapidly attracted from the atmosphere by the precipitate in drying, that it passes into the state of Sesquioxide: and no means hitherto devised have been able to prevent this change from taking place.

To render the preparation as perfect as possible, the sulphate of iron should be recently prepared, and in the state of a pure protosulphate. The precipitate should be washed with hot water until the washings are no longer affected by Nitrate of Baryta; after which, it should be speedily dried in the heat of a vapour bath*.

An imperfect Sesquioxide of Iron is naturally formed in every instance when iron is exposed to a moist atmosphere. The metal is first oxidized, partly by the oxygen of the air, partly by the decomposition of the aqueous vapour—a fact which is demonstrated by the formation of ammonia during the oxidizement, arising from the union of the hydrogen of the water and the nitrogen of the atmospheric air. The oxide thus formed is the well-known *rust*. It is probable, however, that during the preparation of the Sesquioxide, some of the carbonate always escapes decomposition; and the more of it which the preparation contains, the more valuable it is as a Tonic.

When it is carefully prepared, the Sesquioxide of Iron consists, according to Berzelius, of 69·22 per cent. of Iron, + 30·78 of Oxygen, = 100·00; or 1 eq. Iron = 28 + $1\frac{1}{2}$ Oxygen, = 12, equiv. = 40: but the officinal preparation contains water and also Carbonate of Iron; so that the proportion of the constituents must vary in different specimens of the preparation.

Sesquioxide of Iron is of a reddish-brown colour, and dissolves with more or less effervescence in acids, yielding up any carbonic acid it may contain, which it also parts with at a high temperature. When properly prepared, it is soluble in the juices of the stomach, and is readily taken into the circulation. The purity of the preparation is determined by dissolving it in Hydrochloric Acid, when it should leave no residue; and the solution should strike a deep blue with Ferrocyanate of Potassa. When Ammonia is added to the hydrochloric solution, and the oxide precipitated, the supernatant fluid should not indicate the presence of any other metallic salt, nor cause a precipitate with the salts of Baryta. The dose of the Sesquioxide is from ten grains to four drachms.

HYDRATED SESQUIOXIDE OF IRON. *Ferugo.* E. *Ferri Rubigo.* D.—Rust of Iron is this Hydrated Sesquioxide, slowly formed

* The Red Oxide of the Dublin Pharmacopœia is ordered to be prepared by decomposing the Sulphate by heat. It contains no carbonate, and is the old preparation termed Colcothar. It enters into the Strengthening Plaster, Emplastrum Ferri, E.

by the action of air and moisture upon Iron: and the Dublin College orders its Rubigo to be prepared by moistening Iron wire, and exposing it to the action of air: then triturating the iron thus rusted in water, pouring off the water containing the finer particles, and collecting the powder and drying it. The Edinburgh College orders it to be prepared from a solution of ℥iv of Sulphate of Iron in Oii of water, and diluted with f℥iiiss of commercial Sulphuric Acid. This solution is boiled, and, during the boiling, fʒix of Nitric Acid (density 1830) are added in small portions, until the solution acquires a yellowish brown colour, and yields a precipitate of the same colour to Ammonia. The solution is next to be filtered, and Ammonia added to it in a full stream, briskly stirring the mixture. The precipitate, collected on a calico filter, is to be carefully washed until the washings cease to precipitate a solution of Nitrate of Baryta: and, after squeezing out the water, the precipitated Hydrate is to be dried at a temperature of 180°.

This preparation is a yellowish brown powder, soluble in diluted acids without effervescence. When exposed to heat, it gives off Ammonia, and is converted into the red Sesquioxide, the old Colcothar. It contains about 14·7 per cent. of water*; but it may be regarded as a compound of 80 parts of the anhydrous sesquioxide, and 18 of water, = 100 ($Fe.^2$, $O.^5 + 2\,H.O.$) equiv. = 87.)

This Sesquioxide is an excellent Tonic; but it is chiefly employed as an antidote in poisoning by Arsenious Acid and its compounds. As a Tonic, the dose is from grs. v to ℈i; as an antidote, it should be administered in large doses, till twenty or thirty times the quantity of arsenious acid swallowed be taken. For this purpose, it should be kept in a moist state. The rationale of its operation is not well understood.

d. METALLIC SALTS.

SULPHATE OF IRON. *Ferri Sulphas.* L. E. D.—This salt is prepared by dissolving ℥viii of filings of iron in ℥xiv of sulphuric acid, mixed in Oiv of water. Effervescence commences, owing to water being patially decomposed by the iron, aided by the sulphuric acid; the hydrogen escapes, whilst the oxygen is united with the iron, forming a protoxide, which combines with the sulphuric acid, and constitutes the sulphate.

The Dublin College orders four parts of iron wire, seven of sulphuric acid, and sixty of water. By evaporating the solution immediately, crystals of Protosulphate of Iron are obtained; but if it be permitted to remain for some time exposed to the air, it attracts oxygen, and the salt is converted into a

* Berzelius.

persulphate. In the large way, it is procured by roasting iron pyrites and exposing them to air and moisture, by which the sulphur is converted into acid, and, at the same time, the iron is oxidized: by their union, the sulphate is formed.

Protosulphate of Iron has a fine emerald-green colour; is transparent, owing to its containing a large quantity of water; and is crystallized in rhomboidal prisms: but the crystals are very irregular. The taste is styptic, acid, and nauseous. It is soluble in cold water and in three times its weight of boiling water; but it is again deposited as the water cools. It is insoluble in alcohol, in which it can be long preserved unchanged. Its aqueous solution reddens the tincture of litmus. When exposed to the air, it gradually loses its water of crystallization, becomes opaque, and is covered with a yellowish powder, which is a sesquisulphate of the salt: an effect produced by the absorption of the oxygen of the atmosphere. In solution, this absorption of oxygen proceeds more rapidly than when the salt is in the solid state. The Sulphate of Iron of commerce should not be used for medicinal purposes, as it sometimes contains copper.

The Protosulphate of Iron, according to the analysis of Berzelius, consists of (S. O. 3, + Fe. O. + 6, H. O.) or

Sulphuric Acid .	28·9	or 1	eq. =	40·1
Protoxide of Iron	25·7	1	eq. =	36
Water . . .	45·4	6	prop. =	54
	100·0		Equivalent	130·1

The Sulphate, when heated, first loses its water of crystallization; and, if the heat be considerably augmented, it is converted into *colcothar*, the red oxide of Iron.

Dried Sulphate of Iron. *Ferri Sulphas exsiccatus.* E.—This is prepared by exposing the Sulphate in an earthen vessel to a moderate heat until it becomes white and dry. When the salt is a pure Protosulphate, the dried Sulphate is white, and remains so.

Both Sulphates of Iron are decomposed by the alkalies and their carbonates: by the former, a hydrated protoxide falls, and, by attracting oxygen from the air, is converted into the sesquioxide: by the latter, a protocarbonate is formed, and is as rapidly changed into the sesquioxide, the carbonic acid flying off as the oxidizement proceeds. They are also decomposed by phosphates and borates, the Salts of Barium and Baryta, and all the vegetable infusions and decoctions containing tannic acid. Owing to this great susceptibility of decomposition, the sulphate is generally prescribed in the form of pills, in preference to that of solution. This Sulphate is a powerful, but an irritant Tonic. The dose is from gr. i to gr. v; that of the dried Sulphate, gr. ss to gr. iv. It acts better in small doses, fre-

quently repeated, than in large doses. In large doses, it excites nausea, pain at the epigastrium, and vomiting. In the dose of ℈i, it acts as an emetic.

PILLS OF SULPHATE OF IRON, *Pilulæ Ferri Sulphatis*, E. are made by beating together *two parts* of dried Sulphate of Iron, *five* of Extract of Taraxacum, *three* of Liquorice-root powder, and *five* of Confection of Roses: and dividing the mass into five-grain pills.

PILLS OF ALOES AND MYRRH, *Pilulæ Aloës et Ferri*, E. are made in the same manner with *three parts* of Sulphate of Iron, *two* of Barbadoes Aloës, *six* of Aromatic powder, and *eight* of Confection of Roses.

PILLS OF RHUBARB AND IRON, *Pilulæ Rhei et Ferri*, E. consist of *four parts* of Sulphate of Iron, *ten* of Rhubarb, and *five* of Confection of Roses; and the mass is divided into five-grain pills.

These pills are admirably adapted for cases of atonic, gastric dyspepsia.

The Sulphate of Iron is found also in a state of natural solution in mineral waters; the springs of Sand-rock in the Isle of Wight, of Hartfell in Scotland, Wals in France, Moffat, and Vicar's Brig, near Dollar. Hartfell Spa contains 36·75 grains of protosulphate in the imperial gallon: the Moffat strong chalybeate, 5·91 grains of the sulphated peroxide; and Vicar's Brig spring, 1753·10 grains of bisulphated peroxide, and 141·55 of sulphated peroxide. All these waters are readily distinguished by striking a black or deep violet colour with tincture of galls.

ACETATE OF IRON. *Ferri Acetas*. D.—This is a preparation of little value, although the Dublin College has ordered it to be prepared in three different modes. The first is made by digesting one part of Carbonate of Iron (D.) in six parts of Acetic Acid for three days, and filtering. It is merely a solution of the protoxide and sesquioxide in acetic acid. It is of a deep red colour. The dose is m. v to m. xx.

TINCTURE OF ACETATE OF IRON, *Ferri Acetatis Tinctura*, D. is made by mixing, in a porcelain mortar, two parts of Acetate of Potassa and one part of Sulphate of Iron with twenty-six parts of Rectified Spirit, digesting for several days, and filtering. In this process, Acetate of Iron and Sulphate of Potassa are formed. It has the colour of claret, the odour of vinegar. It is a mild chalybeate, and may be administered to children labouring under scrofulous affections. The dose is m. xx to f℥i.

ALCOHOLIC TINCTURE OF ACETATE OF IRON, *Ferri Acetatis Tinctura cum Alcohole*, D. is a mere modification of the former preparation. The dose is m. xx to f℥i. It is a superfluous preparation.

TARTRATE OF POTASSA AND IRON, *Ferri Potassio-Tartras*, L. *Ferrum Tartarizatum*, E. *Ferri Tartarum*, D. is directed to be prepared in a different manner by each of the Pharmacopœias. The London College orders ℥iii of the sesquioxide to be digested in Oss of hydrochloric acid for two hours on a sand-bath, then two gallons of water to be added, and the whole left to precipitate, after which the supernatant fluid is to be poured off. This is to be precipitated with a solution of Potassa, the precipitate separated and washed well; then boiled with ℥xiss of Bitartrate of Potassa in a gallon of distilled water, and the solution of Carbonate of Ammonia added as long as it causes effervescence. The solution is lastly to be evaporated to dryness on a vapour bath. The Edinburgh College orders ℥v of Sulphate of Iron, ℥v ʒi of Bitartrate of Potassa, and a sufficiency of Carbonate of Ammonia. The Dublin preparation is made by exposing four parts of Bitartrate of Potassa and one part of soft Iron wire, and eight parts of distilled water, to the action of the air for fifteen days, in a wide vessel, stirring occasionally, then boiling the product in distilled water, and evaporating the solution to dryness in the vapour bath. In this process, the Iron is oxidized at the expense of the water; as a protoxide, which, attracting the oxygen of the air, is changed into the peroxide, and unites with the excess of tartaric acid of the bitartrate.

This mixed salt is of a greyish-green colour, inodorous, and, although styptic, yet not unpleasant to the taste, and is consequently a chalybeate well adapted for children. It is deliquescent and soluble in four parts of water, and its solution does not soon undergo decomposition. It has the great advantage of not suffering any change when combined with the alkalies and their carbonates; but it is precipitated by the infusions and decoctions of astringent vegetable substances. It is said, by Mr. Phillips, to contain 18 per cent. of Sesquioxide of Iron. It is, however, a compound of 2 eq. of Tartrate of Potassa, + 1 Tartrate of Iron, or 265·9 of Acid, + 94·3 Potassa, + 80 Oxide of Iron.

SACCHARINE CARBONATE OF IRON. *Ferri Carbonas Saccharatum*. E.—This is prepared by decomposing ℥iv of Sulphate of Iron, dissolved in Oii of water, by means of ℥v of Carbonate of Soda in Oii of water, collecting the precipitate on a cloth filter, washing it directly with cold water, squeezing out the fluid; then mixing the residue with ℥ii of pure sugar in powder: and drying the compound at a temperature not much exceeding 120°. In this process, if the sulphate be a protosulphate, the precipitate will be a protocarbonate, and will retain its character for a long time, if kept under water: but if the carbonate be exposed in its damp state to the action of the air, the carbonic acid is driven off by the further oxidizement of

the oxide, and the conversion of the whole into the *Sesquioxide*. The addition of the Sugar, as ascertained by Klaur, prevents the oxidizement of the protoxide, and retains the preparation in the form of a protocarbonate. According to Dr. Christison, however, it appears that the whole of the preparation is not preserved in the state of the carbonate of the protoxide*; and he considers that the loss of carbonic acid is one third of what it should contain, did no decomposition take place. It is most important to avoid employing heat in the process. When it is well made, the preparation has a bluish-green or grey-blue colour; it is inodorous, and has a sweet, strong chalybeate taste. It dissolves with brisk effervescence in hydrochloric acid, losing fifteen per cent. of carbonic acid.

This preparation is more soluble than the sesquioxide, and a more efficient tonic. In large doses, namely, fifteen grains, it causes nausea, cephalalgia, and a sensation of fulness in the head. The dose is from gr. v to ʒss.

The Compound Iron Mixture, *Mistura Ferri composita*, L. D. is intended to be a mixture of Carbonate of Iron and Myrrh, substituted for Dr. Griffith's antihectic mixture†. According to the London College, it is formed by beating together ʒii of Myrrh and ʒi of Carbonate of Potassa with f℥i of Spirit of Nutmeg, adding, gradually, f℥xviii of Rose Water, and ℈iiss of Sulphate of Iron. The Dublin College adds ʒii of Sugar, which may prove useful in rendering the carbonate, formed by the decomposition of the sulphate, less susceptible of oxidizement. It requires to be preserved in well-stopped bottles. The dose is f℥i to f℥ii.

Compound Pills of Iron, *Pilulæ Ferri composita*, L. D. consist of the same ingredients as the foregoing mixture, without the spirit and the water: ʒii of Myrrh, and ʒi each of Carbonate of Soda, Sulphate of Iron, and Treacle, are beaten together in a heated mortar, to a mass proper for making into pills. Double decomposition takes place, and forms Carbonate of Iron and Sulphate of Soda. The treacle is intended to preserve the carbonate of Iron; but it is preferable to make the mass only when it is required to be divided into pills. The dose is gr. x to ℈i.

Pills of Carbonate of Iron, *Pilulæ Ferri carbonatis*, E. consist of four parts of Saccharine Carbonate of Iron and one part of Conserve of Red Roses, beaten into a proper mass, and divided into five-grain pills. This is merely a convenient mode of administering the Saccharine Carbonate. The dose is from gr. v to ʒss.

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* Christison's Dispensatory, p. 426.

† Griffith's Observations on the Cure of Hectic, &c. 1776.

Besides the artificial preparations of Iron, containing the carbonate of iron, this salt is found in a state of natural solution in mineral waters in many parts of the world. The springs of Scarborough, Tunbridge, Peterhead in Scotland, Bourbon l'Archambault, Passey, Pougues de Chateau-Gentier, Pyrmont, Spa, Vichi, and many others, contain Carbonate of Iron. All these waters are readily distinguished by striking a black or deep violet colour with tincture of galls, and a green, which becomes deep blue on exposure to the air, with ferro-cyanate of potassa. When the water which holds the iron in solution suspends it by means of carbonic acid, a yellow or ochry sediment is precipitated by boiling the water; and, after this operation, it ceases to give evidence of its chalybeate nature by the usual tests. These chalybeate waters redden the tincture of litmus before being boiled; but they cease to do this after they have been boiled. If the chalybeate be a sulphate, a precipitate will be formed by nitrate of baryta, and by such means a chalybeate containing the sulphate is distinguished from carbonated chalybeates.

Citrate of the Sesquioxide of Iron, *Ferri Sesqui-Citras.* This salt was introduced to the profession by M. Beral of Paris, in 1831. It is prepared by boiling in a platinum capsule ℥iv of crystallized citric acid and ℥iv of water, and adding, gradually, ℥viii of moist Hydrate of Peroxide of Iron. When cold, the solution is filtered, and the fluid made up to f℥xvi. It must be spread out on glass to dry, which it speedily does, and separates from the glass in thin lamellæ. The Citric Acid combines with the Oxide of Iron, in the proportion of 40 parts of the latter to 70 of the former. It is an uncrystallizable, acidulous salt, scarcely soluble in cold water, but soluble in boiling water.

Citrate of the Protoxide of Iron. *Ferri Proto-Citras.* This is prepared by adding iron filings to a concentrated solution of Citric Acid; filtering the solution and evaporating to dryness. It is a white, pulverulent salt, little soluble in cold water. When exposed to moist air and light, the iron is oxidized, and the salt becomes coloured.

Ammonio-citrate of Iron. *Ferri Ammonio-citras.*—This salt is prepared in the same manner as the sesquicitrate; but the excess of acid is neutralized by Ammonia, and a double salt is formed. As this salt is much more soluble than the Citrate of the Sesquioxide, it is more frequently employed than that salt.

These preparations of the Citrate of Iron, although not officinal, yet, are excellent Tonics. They are, however, more acrid, and consequently more likely to stimulate the mucous membrane than the Potassio-tartrate, which is, therefore, a preferable

chalybeate in cases of irritable gastric dyspepsia. The dose of the Citrate is from gr. ii to gr. vi*.

The preparations of Iron, whether those formed by the hand of Nature, or those contrived by the artifice of Man, exert a powerfully tonic effect upon the living system. They increase the digestive powers of the stomach, stimulate the intestines, and, being dissolved also in the gastric and intestinal juices, they are taken up by the absorbents, enter the blood, and stimulate the whole of the system. This is demonstrated by the pulse being rendered stronger and quicker, the heat of the body and thirst being augmented, the countenance rendered more florid, and the whole powers of the system being called into action. It has been denied that Iron is absorbed into the blood; but a series of experiments, by Menghini, detailed in the second volume of the Bologna Commentaries, places the fact of its absorption beyond a doubt. Forty dogs were fed with food mixed with Iron in different states: on killing them, more iron was found in their blood than in that of the same number of dogs fed in the usual manner; and the quantity varied according to the nature of the Iron employed. Thus, those fed with iron ore had three times more Iron in their blood than those who took no Iron with their food: those fed with iron filings had the next greatest quantity: and those who took the peroxide the least. The cause of these differences is obvious: in the ore, the Iron was in the state of a sulphuret, and easily convertible into a salt in the juices of the stomach, owing to the oxide containing the minimum of oxygen: the Iron filings were not so rapidly rendered soluble; as they had first to suffer oxidizement—a process which could not always be completed before they passed from the bowels: whilst the insolubility of the peroxide readily explains why so little of it is taken into the habit. Tiedemann and Gmelin detected it also in the serum of the blood of the portal and mesenteric veins of horses and dogs, to whom it was administered in the form of sulphate and Chloride. A very striking proof of the absorption of the salts of Iron is detailed by Dr. Home, Professor of the Practice of Medicine in the University of Edinburgh. On testing the urine of a man, to whom he had given a large quantity of the muriated tincture of Iron, with tincture of galls and ferrocyanate of potassa, it afforded evident proofs that it contained a considerable quantity of Iron. But the absorption is slowly effected; and neither the black colour of the fecal discharges, nor the results of testing the excretions, indicate the presence of the Iron for some days after the use of any of the prepara-

* Another preparation of the Citrate—namely, *Citrate of Iron and Quina*, has been lately introduced. It is in the form of transparent garnet-coloured laminæ, soluble, and very bitter. It possesses no advantages over the Ammonio-citrate.

tions has commenced. Berzelius supposes that the Iron exists in the blood in a metallic state, not in that of an oxide. Chlorine, it is true, readily separates it from a watery solution of the blood, which would not be the case were it in the state of oxide.

With regard to the medicinal powers of the salts of Iron, the natural chalybeates are eminent Tonics: their primary effect is displayed in the digestive organs; whence their influence is propagated, rousing the nutritive faculty in every part of the body: they augment the power of the secretory system; and, by the moderate but permanent nature of the impression which they impart to the nerves, increase the tone and general vigour of all the functions. Something is undoubtedly due to the circumstances connected with drinking mineral waters at their source;—when the cares and anxieties of life have been left behind, in the smoky alley and crowded street, when Hope and Confidence and Amusement lend their invigorating aid to the tonic influence of the salutary fountain. But tone follows the use of Iron in all its forms.

NITRATE OF SILVER. *Argenti Nitras.* L. E. D. Syn. *Lunar Caustic.*—This Nitrate is readily prepared by acting upon ℥i of pure silver by means of ℥iss of nitric acid diluted with f℥ii of water; and, when the solution is complete, expelling the whole of the water by an augmented heat, fusing the salt and forming it into cylinders by pouring it into moulds slightly greased. The Dublin College orders thirty-seven parts of pure silver, flattened and cut into pieces, to be dissolved in sixty parts of diluted nitric acid; and, when dissolved, treated as above. The Dublin College also orders the Nitrate to be kept in crystals, under the name *Argenti Nitras crystalli.* The crystals should be kept in an opaque, stopped bottle: but this may be regarded as a superfluous preparation, possessing no advantage over the fused nitrate, well prepared. The metal is oxidized at the expense of a portion of the acid, and then dissolved in the remainder.

Nitrate of Silver, in its crystallized state, is in brilliant rhombic plates, colourless, inodorous, and having an extremely bitter, caustic taste. It stains the cuticle black. It fuses at a temperature equal to 426° Faht. and is decomposed if the heat is raised to 600°. The crystals dissolve in their own weight of water at 60°, and in four parts of weak alcohol. They are permanent in the air; and, when the Nitrate is pure, and the water also is pure distilled water, no decomposition takes place: but the smallest portion of animal or vegetable matter causes it to become dark-coloured when exposed to light. The cylinders of the Nitrate, or *lunar caustic,* when pure, are whitish; but they become dark when the moulds are oiled.

Nitrate of Silver is precipitated from its solution by lime

water, and the chlorides, hydrochlorate of ammonia, the alkalies and their carbonates. Water, therefore, containing these salts, which is the case with all hard waters, should never be employed in prescriptions with Nitrate of Silver. It is also decomposed and precipitated by sulphuretted hydrogen and the alkaline sulphurets; by borate and phosphate of soda; and by tincture of iodine: all of which are, therefore, incompatible in formula with Nitrate of Silver.

Nitrate of Silver is a compound of—($Ag. O. = N. O.^5$)—

Nitric Acid	1 eq. =	54·15	or 68·61
Oxide of Silver	1 eq. =	116	31·39
Equivalent		170·15	100·00

Nitrate of Silver communicates general tone to the habit, through the medium of the nerves of the stomach, upon which its primary action is exerted; but it is also absorbed and taken into the circulation—a fact demonstrated by the leaden hue which it sometimes communicates to the skin of some persons who take it. Although it operates as a powerful escharotic when applied to the surface of the body, yet the vitality of the stomach is sufficient to resist its chemical influence: its dose may be carried to the extent of even five grains, three times a-day. The best mode of administering it is in the form of pills, made up with the crumb of bread. It is always advisable to preface its use by emptying the stomach and bowels; for when much acid, either hydrochloric or acetic, exists in the alimentary canal, the Nitrate is decomposed and rendered inert. No salted food, nor much salt, should be used by persons taking the Nitrate; as these form an inert chloride of silver in the stomach.

When Nitrate of Silver has been overdosed, its injurious effect on the stomach may be counteracted by diluting freely with salt and water, so as to decompose the Nitrate and render it inert: but if there be time for inflammation to be induced, then the case must be treated in the same manner as inflammation of the stomach.

Nitrate of Silver was early employed as a tonic, in the treatment of disease; but, from want of due precaution in its administration and the harshness of its operation, it fell into disuse. It was reintroduced by Dr. Simms, of London, who employed it in the treatment of epilepsy; and from his success it became much used; truth, however, obliges me to say, that, except in protracting the return of the paroxysms in symptomatic epilepsy, little is to be expected from its employment. In chorea, however, its merits have not been too highly extolled. It is taken into the circulation, stimulates moderately, and increases the general tone of the habit; lessening thereby the inordinate irritability and mobility of the system. I have given it also, with great advantage, in angina pectoris.

The dose at first should not exceed one sixth of a grain; but it may be gradually augmented to four or five grains.

The effect of the Nitrate on some habits, as already mentioned, stands in the way of its general employment as an internal medicine. This effect does not appear to depend on the quantity of the medicine which is given; nor does it occur frequently: two questions, therefore, arise—what is the cause of this change of colour of the skin? and is there any probability of a remedy for it being discovered? In reply to the first of these queries, if we admit that the Nitrate is taken into the circulation undecomposed, and arrives in that state at the capillaries of the skin, we must also admit that it may be decomposed there, converted into chloride of silver, and deposited in the rete mucosum. The chloride, we know, acquires a grey, leaden colour, whenever it remains in contact with animal matter; and, as it is insoluble, and incapable of being reabsorbed, it is fixed in the rete mucosum, and a permanent stain is given to the skin. This effect, therefore, happens whenever a more than usual quantity of chlorides is separated by the cuticular capillaries. With respect to the second query, it must be admitted that no certain remedy has yet been suggested; but what I have to propose, having been now supported by experience, I offer with some confidence. I imagine that, by ordering diluted nitric acid, at the time of administering this salt, its decomposition may be in some degree prevented.

As a local Tonic, the Nitrate of Silver has been lately successfully employed in chronic inflammation of the eyes: and to its local influence, in great part, may be ascribed its utility in affections of the mucous tissues and secreting surfaces; in ulcerations, as recommended by Mr. Higginbottom; and in checking erysipelas, by brushing over the inflamed part with the officinal solution. It is true that it acts in ulcerations, by forming, as it were, an artificial cuticle on the part, which chemically unites with the Nitrate; but I am inclined to believe that something is also due to its tonic power. On the same principle, it cures inflammation of the cervix uteri depending on increased irritability of the part.

Solution of Nitrate of Silver. *Liqour Argenti Nitratis.* L.—One drachm of the Nitrate is ordered to be dissolved in a fluid ounce of water; filtered and preserved in a well-closed vessel in a dark place. If the Nitrate of Silver be pure, and the water well distilled, there is no occasion to filter, and the precaution of darkness is scarcely requisite. It is a useful solution, being of the proper strength, as an application in Erysipelas, Lupus, and similar affections of the skin. Twenty minims of it in f℥ii of water form a good gargle in relaxed and irritable conditions of the uvula and fauces.

Solution of Arsenite of Potassa. *Liquor Potassæ Arse-*

nitis. L. *Liquor Arsenicalis*. E. D.—The London and the Edinburgh Colleges order *eighty grains* of Arsenious Acid, and the same quantity of Carbonate of Potassa, to be boiled in *half a pint* of distilled water, in a glass vessel, until they are dissolved; then to add *five fluid drachms* of compound Tincture of Lavender to the cooled solution; and, lastly, as much distilled water as will bring up the whole to one pint.

This solution is intended as a substitute for Dr. Fowler's solution, which was introduced to the profession in 1786, under the name of *Solutio Mineralis*. The object of the addition of the Tincture of Lavender is merely as a colouring matter; it neither adds to nor abstracts from the value of the preparation. It is an admirable Antiperiodic and Tonic, and may be given in divided doses every two hours during the apyrexia. It determines to the surface, equalizes the circulation, excites the cutaneous capillaries, and improves the general action of the skin. If it accelerate the pulse, excite a sensation of itching, cause tenderness of the eyes, with swelling and stiffness of the eyelids, and these symptoms are followed by tormina, weakness of the stomach, and much depression of spirits, its employment must be discontinued, as they are the signs of its poisonous influence.

The dose, as a Tonic, is from m. v to m. x, gradually augmented to m. xx; but its action, whilst the dose is increased, must be carefully watched.

Chlorate of Potassa. *Potassæ Chloras*. L.—This salt is prepared by passing Chlorine, extracted from a mixture of eleven parts of hydrochloric acid and five of black or binoxide of manganese, through a concentrated solution of carbonate of potassa in a Wolf's apparatus. In this operation, the hydrochloric acid is decomposed: the chlorine passes over in a gaseous state, whilst the hydrogen, uniting with 1 equivalent of the oxygen of the binoxide of manganese, forms water. The Chlorine thus given over, passes into the solution of the alkali, decomposes a portion of it, and, uniting with its oxygen, forms chloric acid. The Potassium thus formed, combines with a portion of the Chloride of Potassium, which crystallizes; thus forming two distinct salts—a chloride held in solution, and a chlorate. This latter salt is produced in white, pearly, hexædral plates, soluble in fifteen parts of water at 60° Faht. and two parts and a half of boiling water, from which it is deposited in cooling. The Chlorate of Potassa is inodorous, has a cool, austere taste, not unlike that of nitre; and, when heated to redness, fuses, and gives out more than a third of its weight of oxygen gas, leaving in the retort a simple chloride of potassium. According to Robiquet, the whole of this oxygen is not abstracted from the decomposition of the *Chloric* acid; but one-fifth is from the *Potassa*, which is reduced to the

metallic state, in order to unite with the chlorine and form the chloride.

Chlorate of Potassa contains no water of crystallization: it is a compound of ($Clo.^5 + K. O.$)

Chloric Acid	1 eq.	= 76·42	or	61·228
Potassa . .	1 eq.	= 47·15		38·772
	Equivalent	= 112·67		100·000

As a remedial agent, the Chlorate of Potassa operates as a stimulant Tonic; but whether it imparts oxygen to the system from the decomposition of the salt in the body, as has been supposed, is uncertain: on this supposition, however, it was, at one time, employed in the treatment of syphilis and sea-scurvy. In what part of the system the decomposition is effected, if it take place, is not easily ascertained: but as the Chloride of Potassium is a Tonic, the influence of the Chlorate is not altogether dependent on the extrication of the oxygen: its use, therefore, is chiefly indicated in those states of the habit in which the powers of the system require to be roused, and, at the same time, a permanent tonic effect obtained; as, for instance, in the sinking stage of typhoid fever; particularly in that attended with eruptions, as, for instance, malignant smallpox and scarlatina. As a remedy in syphilis, it has justly fallen into disrepute. The dose is from gr. vi to ℈i in solution, three or four times a day.

ACIDS.

SULPHURIC ACID. *Acidum Sulphuricum.* L. E. D. Syn. *Oil of Vitriol. Acidum Sulphuricum purum.* E. D.—This is a compound of sulphur, oxygen, and water: namely, of 40 parts of Sulphur, + 60 of Oxygen, = 100, or Sulphur 1 eq. = 16·1, + Oxygen 3 eq. (8×3) = 24, making the equivalent 40·1. The acid of the Pharmacopœias has a specific gravity of 1·850; and it is a compound of

Anhydrous Acid	1 eq.	= 40·1	or	81·63
Water . . .	1 eq.	= 9		18·37
	Equiv.	49·1		100·00

It is a colourless, transparent, heavy fluid, with the consistence of oil. It boils at 620°, and freezes at 15° below zero; but, when diluted so as to bring its sp. gr. to 1.78, it congeals at 32°, and remains solid under 45°. It is inodorous, has an intensely acid taste, and is so acrid that it cannot be applied to the tongue with safety in the undiluted state. In the concentrated state, it speedily chars all animal and vegetable bodies, and has so great an affinity for water, that it imbibes one third of its weight from the air in twenty-four hours. When it is suddenly combined with water, in the proportion of one part to three of the acid by weight, the condensation of the mixture is considerable, and much latent

caloric is disengaged in a sensible form, raising the thermometer from 50° to 300° of Faht. The dilution of the Acid of Commerce precipitates any salt of lead which it contains, and whilst the Acid is thus rendered turbid, some nitrous fumes occasionally escape. On cooling, it again becomes limpid, and may be decanted from the precipitate. It chars all vegetable and animal matters that come in contact with it. Sulphuric Acid unites readily with the alkalies, earths, and most of the metallic oxides, forming the salts called *sulphates*. The London College regards the ordinary or commercial Acid sufficiently pure for medicinal use, as it is never administered internally undiluted: but the Edinburgh and Dublin Colleges order it to be purified. The process of the Edinburgh College is founded on the investigations of Wackenroder*. To f℥viii, between gr. x and gr. xv of sugar are added, and the whole kept at a temperature not quite sufficient to boil the Acid, till the dark colour at first produced shall have nearly or altogether disappeared. This process removes the nitrous gas. But in order to remove other impurities, the Acid must be distilled in a glass retort containing a few pieces of platinum. I have found it necessary to sink the retort in the sand of the bath so as to cover it altogether. No luting should be employed, and the first half-ounce of the Acid which comes over should be rejected.

Free Sulphuric Acid is probably never found in nature, although M. Baldassari has published an account of his having discovered it, in a solid, crystallized state, in a grotto of Mount Amiata, below the baths of St. Philip. It is, however, found in an impure state near the craters of volcanoes. Humboldt says that it is contained, in conjunction with hydrochloric acid, in the waters of the *Rio Vinagre*: Vauquelin, also, has detected it in the water of a mountain lake in the island of Java.

Sulphuric Acid may be artificially prepared by the direct combination of its components. Thus, if sulphur be burnt in oxygen gas, *over water*, this acid is formed, and is taken up by the water; but nearly all the liquid Sulphuric Acid, employed both in trade and in medicine, is manufactured by burning a mixture of eight parts of sulphur and one of nitre in leaden chambers containing water. In this process the nitre is decomposed. Sulphurous Acid and Nitrous Acid gas are formed, the latter of which is again decomposed, converts the Sulphurous into Sulphuric Acid, and then becomes Hyponitrous Acid†. These new Acids, mixing with the aqueous vapour in the chamber, form a new compound, that, dropping into the water, is decomposed and forms Sulphuric Acid, which is absorbed by the water. This process is carried on until the water is highly charged with the acid; after which it is concentrated by evapo-

* Christison's Dispensatory, p. 47.
† Records of General Science, vol. iv, p. 96.

ration, and forms the Sulphuric Acid of commerce. It generally contains sulphates of lead and of potassa; but as the acid is purified by diluting it for medicinal use, the sulphate of lead is thrown down, in the form of a white powder, on the addition of the water.

DILUTE SULPHURIC ACID. *Acidum Sulphuricum dilutum.* L. E. D.—It is to be regretted that the strength of this acid differs in the three British Pharmacopœias: in the London, f℥iss of the strong acid is ordered to be diluted with f℥xivss of distilled water; in the Edinburgh, f℥i with f℥xiii; and in the Dublin, one part and seven parts. The proportion, therefore, of acid ordered by the London College is one part to five and a half parts of water by weight; that of the Edinburgh and Dublin, about one to seven. A fluid drachm of the London diluted acid contains about ten grains of the strong acid. The dose is m. xv to m. xxx.

AROMATIC SULPHURIC ACID, *Acidum Sulphuricum aromaticum,* E. D. is prepared by first adding gradually three fluid ounces and a half of Sulphuric Acid to one pint and a half of Rectified Spirit, and digesting the mixture, at a very gentle heat, for three days, in a closed vessel. An ounce and a half of powdered Cinnamon and an ounce of powdered Ginger are then mixed together, and moistened with a little of the Acid Spirit, and after twelve hours, the mass being put into a percolater, the remainder of the Acid Spirit is to be transmitted through it. This is an imperfect etherial Acidulous Tincture of Cinnamon and Ginger. It is a more agreeable preparation than the simple diluted Acid. The dose is m. xv to m. xx, in any bitter or tonic infusion or decoction.

Sulphuric Acid, when properly diluted, is a Tonic of very considerable power. Its influence is extended, through the circulation, to every part of the system. It is much used in continued fevers, especially those in which the debility is so great as to admit of the escape of blood from the intestinal vessels; and it is the only remedy, in conjunction with wine, on which we can rely in the confluent smallpox, when the pustules are filled with a bloody sanies, and the urine is coloured by broken-down particles of blood. In a general point of view, we may safely consider it proper to be administered in all those fevers accompanied with extreme debility, and with what has been termed a putrid tendency in the habit. In cases of immoderate perspiration —as, for instance, in the hectic of phthisis pulmonalis—it is the appropriate remedy; and, in combination with aromatics, it removes many of the urgent symptoms of dyspepsia: it is altogether a Tonic of the highest value when judiciously employed. In administering it, however, even in the diluted state, some anomalous effects occur which should be retained in remembrance. Thus, when given to women who are suckling, it acts

powerfully on the system of the infant, causing gripings, and frequently convulsions,—a fact illustrated by the following quotation from a case, extracted from a German Journal, which appeared in the Medical Gazette of May the 10th, 1828. A woman poisoned herself with concentrated Sulphuric Acid. "The last efforts of Nature were exerted to give birth to a child, in whom, upon examination, Sulphuric Acid was detected in the cavity of the pleura and the peritoneum, and also in the heart and bladder. Its presence was also ascertained in the liquor amnii."

Diluted Sulphuric Acid is given in combination with vegetable infusions and decoctions; but it cannot be combined in prescriptions with chloride of calcium, lime water, barytic water, or the solution of acetate of lead, or chloride of barium; insoluble compounds being produced by these combinations.

If the strong acid be taken into the stomach, it operates as an irritant corrosive poison; producing violent pains of the stomach and chest, and a burning sensation in the mouth and throat, at the same time that an icy coldness is felt all over the body. In this case, no time must be lost, but magnesia, dissolved in water, should be freely and repeatedly administered; using the stomach-pump in the intervals between each dose. If magnesia be not at hand, any alkaline bicarbonates will answer equally well. It often happens that the poison is vomited almost as soon as it is taken; but the patient is not on this account secure, for he may still die of the corrosive influence of the acid. In a case which occurred at the Hotel Dieu, although the poison was instantly vomited, yet the stomach could not afterwards retain either solid or fluid aliment, however mucilaginous or mild; and the man died sixty days after having taken the poison. The stomach was contracted in an extraordinary degree: it was perforated on the anterior parietes; and the edges of the perforation had contracted adhesions with the concave surface of the liver: no extravasation had taken place; and the interior of the viscus presented numerous cicatrices of very recent date, but all completely formed.

DILUTE PHOSPHORIC ACID. *Acidum Phosphoricum Dilutum.* L.—This is a compound of Phosphorus, Oxygen, and Water. It may be procured in various ways; but the following is the process of the London College. An ounce of Phosphorus, and four fluid ounces of Nitric Acid, mixed with ten fluid ounces of Water, are put into a glass retort, and heat applied in a sand bath until eight fluid ounces are produced. These are returned into the retort and f℥viii again distilled. These are to be rejected, and the remaining fluid evaporated in a platinum capsule to two ounces and six drachms: and to this, when cold, is to be added as much distilled water as will make up f℥xxviii. In this process, the Nitric Acid is decomposed and yields up its

Oxygen to acidify the Phosphorus. As the Nitric Acid is diluted, the action is slow, and a portion of it passes over undecomposed; hence the necessity of returning the first f℥viii of liquid which passes over to the retort. When the Nitric Acid is not diluted, the action is violent, and much deutoxide of Nitrogen is disengaged, with which Ammonia is also formed by combining with the hydrogen of the decomposed water.

Diluted Phosphoric Acid is colourless, inodorous, and very acid to the taste. It does not, even in a highly concentrated form, corrode animal fibre. It consists of 57·14 parts of Phosphorus + 42·86 of Oxygen, or 2 eq. of Phosphorus 31·4 + 5 eq. Oxygen = 40, making the equiv. = 71·4 ($P.^2 + O.^5$).

Phosphoric Acid may be administered in the same cases as Sulphuric Acid. It has been employed to destroy the tendency to form bony excretions; and, also, the urinary phosphates.

Nitric Acid. *Acidum Nitricum.* L. E. D. *Acidum Nitricum purum.* E.—Liquid Nitric Acid is a heavy, colourless fluid, emitting, when exposed to the air, dense, disagreeable acid fumes: its taste is intensely acid; it is corrosive; and, when applied to the skin, it tinges the cuticle of an indelible yellow colour, destroying it, and causing it in a few days to peel off. Its specific gravity is 1·513. It has a great affinity for water, and attracts it from the air; and, when water and the acid are suddenly mixed, heat is evolved. It frequently contains a little Nitrous Acid, which gives it a yellowish tinge; but, by heating the acid, this is driven off, and it remains colourless, unless it be exposed to the direct rays of the sun, when it is slowly and partially decomposed, oxygen is evolved, and, Nitrous Acid being formed, a yellowish tinge is communicated to the whole fluid. The strong acid consolidates at 50°; its boiling point is 248°; but at this temperature it is decomposed; and decomposition is also effected with great rapidity by some combustible bodies: as, for example, dry charcoal and oil of turpentine, in both of which cases combustion ensues. It oxidizes nearly all the metals, whilst deutoxide of Nitrogen is evolved: but with several metals, iron among the number, the acid is not acted upon by the metal, unless diluted with half its bulk of water. It tinges Morphia and Brucia a blood-red colour. It unites with oxides of metals and with alkalies, forming salts which are named nitrates.

Liquid Nitric Acid is a compound of anhydrous Nitric Acid and water, in the proportion to each other as 75 to 25; but this is the greatest strength of liquid Nitric Acid, its specific gravity being 1·504. The anhydrous acid cannot exist except in a state of combination with some salifiable base; as, for example, in nitrate of potassa. The elements of the anhydrous acid are—1 eq. of Nitrogen = 14·15 + 5 equiv. of Oxygen (8×5) = 40, equiv. = 54·15; or 25·9 + 74·1, = 100·0 (N. O·5). But this acid exists only in the nitrates: the acid of the Pharmaco-

pœias consist of 1 eq. of anhydrous acid $= 54{\cdot}15 + 1\frac{1}{2}$ of water $= 13{\cdot}5$, making the equivalent $= 67.65$.

For medicinal purposes, Nitric Acid is procured by distilling together, in a tubulated retort, two parts of dried nitrate of potassa and nearly two parts of sulphuric acid. The theory of its production is simple: the affinity of the sulphuric acid for the Potassa is greater than that of the nitric; the sulphuric, therefore, when aided by a high temperature, breaks the affinities between the Nitric Acid and the potassa of the nitrate, a double decomposition takes place, the anhydrous sulphuric acid, contained in the liquid acid employed, combines with the potassa, whilst its water combines with the dry nitric acid of the nitrate, now set free, and passes over into a quilled receiver, attached to the retort, where it is condensed, whence it drops into a bottle in the state of liquid Nitric Acid. A bisulphate of potassa remains in the retort: a quantity of oxygen gas is generally evolved towards the end of the operation, and may be collected. The strongest Nitric Acid which can be procured by this process is of spec. grav. 1·504.

If the nitrate of potassa have been pure, it contains little Nitrous Acid, which can be readily expelled. But the Nitric Acid of commerce always contains both sulphuric and hydrochloric acid; the first is detected by largely diluting the acid and adding a weak solution of nitrate of baryta; the second is detected by adding a solution of nitrate of silver to the diluted acid. The proportion of these adulterations is ascertained by adding to a specific quantity of the suspected acid, largely diluted with distilled water, as much of the reagent as will precipitate the foreign acids; then drying the precipitate and weighing it. If the adulteration be hydrochloric acid, its quantity may be determined by the weight of the dried chloride of silver and the proportion of hydrogen necessary for forming the chlorine into hydrochloric acid: if the adulteration be sulphuric acid, the simple weight of the sulphate of baryta obtained, informs us of the proportion of the sulphuric acid existing in the acid. Nitric Acid, for medicinal use, may be freed from these adulterations by slowly redistilling it.

As a medicinal agent, Nitric Acid is never administered unless largely diluted: it is less powerful as a general Tonic than sulphuric acid, and it differs from it in undergoing decomposition in its passage through the circulation; operating, consequently, rather by affording oxygen to the system than as a Tonic in its entire state. It possesses some advantage over sulphuric acid in cases of dyspepsia accompanied with sickness and great irritability of the stomach, as it rapidly allays these symptoms. It is also admirably adapted for keeping up the tone of the system under the irritation of a mercurial course; as it does not interfere with, but rather favours, the action set

up by the mercury. For the same reason, it proves highly beneficial in alterative courses of mercurials in obstinate ulcerations of the legs, and in cases of impetigo. I have frequently administered the bichloride of mercury dissolved in Nitric Acid, without observing any inconvenience to result from the combination.

Nitric Acid, as I have already mentioned, can be administered only when largely diluted; and, therefore, to facilitate its administration, the Colleges order the acid to be kept in a diluted state.

DILUTED NITRIC ACID. *Acidum Nitricum dilutum.* L.E.D. This, according to the London College, is a solution of one fluid ounce of Pure Nitric Acid in nine fluid ounces of distilled water. The Dublin College orders three parts, by measure, of pure Nitric Acid, and four parts of distilled water.

The dose of this diluted acid is from m. x to m. xxx in f℥ii of water, sweetened with simple syrup. In this state it forms an agreeable potion, which is seldom objected to by patients, and which may be repeated every third or fourth hour. In cases of purpura, nothing facilitates the restoration of tone sooner than the liberal use of this potion. As an external or topical Tonic, a lotion of the diluted acid, formed by adding fʒii to f℥viii of water, is a useful application to old and indolent ulcers. The strength of the lotion may be proportionate to the degree of stimulus which the sores require: in half the above-mentioned strength, it forms a useful gargle in indolent ulcerations of the tonsils.

It is incompatible in prescriptions with sulphate of iron; alcohol; combustibles; acetates of lead, of mercury, and of potassa: and hydrochloric acid forms with it a distinct compound-nitro-muriatic acid which contains free chlorine. It cannot be properly prescribed in form of drops, in conjunction with tinctures, particularly those containing volatile oils; for instance, lavender, cinnamon, and orange peel.

Nitric Acid, taken in a concentrated state, is a most virulent poison. The mucous membrane of the mouth becomes white, thickened, and slightly yellow in some places, and is easily detached: the epidermis of the lips is separated from the borders of the mouth, generally in a semilunar form, as if the glass from which the poison was taken had left the mark upon the lips. The general appearance of the face indicates the utmost anxiety; the pulse is small, scarcely perceptible; and there is the same icy coldness of the surface as in poisoning by sulphuric acid. The patient groans deeply, and complains of pains of the throat and of the stomach; is afflicted with almost unceasing nausea and frequent vomiting; and, notwithstanding the coldness of the surface, large drops of sweat stand upon the face and chest. If these symptoms be not relieved, death

generally ensues within twenty-four hours from taking the poison.

In such cases the stomach-pump should be used; and a mixture of magnesia and water, and mucilaginous drinks, administered; and, after the stomach has been emptied, bleeding, and the employment of counter-irritants*.

NITRO-MURIATIC ACID. *Acidum Nitro-muriaticum.* D.—This acid is prepared by mixing together one part, by measure, of Nitric Acid, and two parts of Hydrochloric Acid, in a cooled vessel. The mixture should be kept in a stopped bottle, in a cool, dark place. In this process the Hydrochloric Acid is decomposed and resolved into Chlorine and Hydrogen: the nitric into nitrous gas and oxygen, with the last of which the Hydrogen water is formed; and the new acid is a mixture of Nitrous Acid and Chlorine.

This acid has an orange-red colour, emits a suffocating odour of Chlorine, with which it rapidly parts. It is a powerful, irritant, corrosive poison. In moderate doses, namely, m. viii to m. xvi, in a glassful of water, it proves Tonic; but it possesses no advantages over the Hydrochloric or the Nitric Acid.

HYDROCHLORIC ACID. *Acidum Hydrochloricum.* L. *Acidum Muriaticum.* E. D. *Acidum Muriaticum purum.* E.—This acid is the only known combination of Chlorine and Hydrogen. It is a gas in its anhydrous state: and the fluid Acid constantly exhales the gaseous Acid.

Hydrochloric Acid is prepared by acting on common salt, Chloride of Sodium, by an equal weight of Sulphuric Acid. In this process, one proportion of the water of the Sulphuric Acid and the Chloride of Sodium are decomposed; the hydrogen of the water unites with the chlorine of the Chloride, and forms the Hydrochloric acid gas, which is absorbed, at the moment of its formation, by the water of the retort, and, rising with it, is condensed in the receiver, in the form of *Liquid Hydrochloric Acid,* whilst the oxygen of the decomposed water unites with the Sodium, and converts it into an oxide, fitting it to combine with the Sulphuric Acid and form a Sulphate of Soda. In conducting the pharmaceutical operation to obtain the medicinal acid, it is necessary to dilute the Sulphuric Acid before pouring it upon the salt in the retort, to prevent the violent action which takes place when it is used in a concentrated state. Water dissolves 464 times its volume of Hydrochloric acid gas to form the liquid acid. In the directions of the dif-

* As a poisonous agent, there are various means of detecting Nitric Acid: the two following are the best—1. Drop a crystal or a few particles of Morphia and Brucia into the suspected acid; if it be Nitric Acid, a blood-red colour is evolved.

2. Drop one or more of the scaly crystals of Cyano-hydrargyrate of Iodide of Potassium into the suspected acid, concentrated; Iodine is instantly evolved, and the scale becomes black.—*Chemist,* July, 1841.

ferent Colleges for forming it, those of the Edinburgh College are to be preferred; equal weights of Chloride of Sodium, Sulphuric Acid, and water, being ordered. The acid is mixed with one-third of water and cooled, and then poured on the chloride, in a glass retort, the rest of the water being put into the receiver. The sp. gr. of this acid, thus procured, is 1·170. The intention of drying the chloride at a red heat before using it is to decompose the nitrates, which are occasionally found in it.

Liquid Hydrochloric Acid, when perfectly pure, is colourless, very sour and acrid to the taste, emits, when exposed to the air, suffocating fumes, which, as well as the liquid acid, redden the vegetable blues, and become more opaque when a glass rod, dipped in liquid ammonia, is held over them, owing to the immediate formation of Hydrochlorate of Ammonia. Water at 40° dissolves 480 times its bulk of these fumes. The pure liquid acid, as ordered by the London College, should have a sp. gr. 1·160, and contain one-third its weight of the gaseous acid. It should not, when sufficiently diluted, afford a precipitate with the Chloride of Barium. It unites with some salifiable bases and forms Hydrochlorates; but when it is made to react upon the metallic oxides, it is decomposed, and Chlorides are the result. It is composed of Hydrogen 1 eq. = 1, + Chlorine 1 eq. = 35·45, equiv. = 36·45; or 2·7 Hydrogen, + 97·3 Chlorine, equiv. = 100·0.

In the acid of commerce, iron is often present, and gives it a yellowish colour; but this is easily removed by redistillation; and for medicinal purposes it does no harm.

Hydrochloric Acid is a powerful Tonic, and as such is frequently and advantageously employed in typhus and other fevers of a similar type. I can bear ample testimony to its efficacy in malignant ulcerated sore throat, such as is frequently epidemic in the metropolis, both internally used and in gargles, combined with the tincture of capsicum, in infusion of roses. It is an excellent application to the gangrenous ulcers which occur in a spongy or scorbutic state of the gums, and in gangrenous sore throat. It is applied by a small piece of sponge, fixed on a bougie or piece of whalebone, and, after being soaked, pressed so as to squeeze out of it all the superfluous acid. The sponge is then to be conveyed to the ulcers and pressed upon them. The first effect is seemingly to increase the inflammation. Whether the tone produced by this acid, in these diseases, is to be attributed to the action of the entire acid on the nervous energy, or to its decomposition and the action of the chlorine, I will not venture to determine; although, from the effects of chlorine in its uncombined state, there is reason to lean to the latter opinion. In a concentrated state, Hydrochloric Acid is a virulent poison.

The dose of liquid acid is from ♏. x to ♏. xx in f℥ii of water or any vegetable infusion.

Diluted Hydrochloric Acid, *Acidum Hydrochloricum dilutum*, L. *Acidum Muriaticum dilutum*, E. D. is made by mixing together four fluid ounces (ten measures, D.) of the Acid and twelve fluid ounces (fourteen measures, D.) of Distilled water. This diluted acid is always prescribed when the acid is internally administered. The dose is ♏. xl to ♏. lx.

Arsenious Acid. *Acidum Arseniosum*. L. *Arsenicum album*. E. *Arsenici Oxydum album sublimatum*. D.—When metallic Arsenic is heated, with free exposure to air, it is changed into Arsenious Acid; and the same substance is produced by digesting it in nitric acid, which is decomposed and yields its oxygen to the Arsenic. On a large scale, Arsenious Acid is obtained during the roasting of the ores of arseniuret of copper. It undergoes a second sublimation to purify it, and is thus formed into hollow cakes, which are generally transparent on one side, white and opaque on the other, and break with a conchoidal fracture. The transparent acid becomes opaque when exposed to the air. In this form, it is sufficiently pure for medicinal purposes.

Arsenious Acid is volatile at a temperature of 380°: in this state it is inodorous; but, if it be placed on red-hot coals, it exhales the odour of garlic, owing to its partial reduction to the lowest state of oxidizement. It requires nearly 400 parts of cold water to dissolve one part of Arsenious Acid; but the solubility of the acid, in its transparent and opaque state, is different: 1000 parts of boiling water take up 97 parts of the transparent acid, and retain 18 parts when cold; boiling water takes up 115 parts of the opaque variety, and retain 29 on cooling. This is an important practical fact. Its solution, when evaporated, yields the Arsenious Acid in regular octohædrons. It feebly reddens the vegetable blues. It is nearly tasteles, and is inodorous. It is soluble in small quantity, in alcohol and in oil, and readily unites with salifiable bases.

Arsenious Acid is a compound of 2 eq. of Arsenic = 75·4 + 3 of Oxygen = 24, equiv. = 99·4. For medicinal use, the white Arsenic sold in powder should never be employed, as it is generally adulterated with sulphate of lime—a fraud easily detected by exposing the powder to a heat sufficient (380°) to volatilize the Arsenious Acid.

Arsenious Acid is decomposed by various reagents. It is precipitated from its aqueous solution by lime water in the form of a white powder, which is an arsenite of lime; by sulphuretted hydrogen, as a sulphuret of Arsenic; by ammoniacal nitrate of silver, as a yellow arsenite of silver; by the solution of cuprum ammoniatum, as *Scheele's green;* and, lastly, by metallic

copper, in which case an alloy of the copper and the metallic Arsenic is formed.

It has been asserted that Arsenious Acid was known to the ancients, as the word Αρσενικον is mentioned by Dioscorides; but whether this was Arsenious Acid is not easy to determine*. The first process for obtaining it is detailed in the Pharmacopœias of Schroeder, published in 1649; but it was not until 1733, when Mr. Brandt, a German chemist, examined the metal and ascertained its affinities, that the nature of Arsenious Acid was well understood.

Arsenious Acid, or white Oxide of Arsenic, as it is called, has a most powerful action on the animal œconomy; but, when the dose is properly apportioned, it is a valuable and sufficiently manageable Tonic in intermittent fevers and other diseases requiring the aid of this class of remedies. It has long been employed in the fenny districts, under the name of "*tasteless* ague drop;" but there are objections to it which have almost superseded its employment; and it should be recollected, that if arsenical oxides or salts are to be employed, those forms of administering them ought to be preferred which are attended with the least risk, and the dose of which is most easily apportioned. Now, the Arsenious Acid, from the variations in its solubility, cannot be administered in solution without some risk.

The Arsenious Acid has been given, with benefit, in those cases of chronic rheumatism which assume the intermittent type: it has also proved occasionally useful in symptomatic epilepsy, chorea, and other spasmodic affections, as well as tic douloureux and cephalalgia. I have had much experience of its efficacy in lepra and some other cutaneous diseases, when given in conjunction with large doses of the pure alkalies and with conium. In the treatment of cancer, Arsenious Acid has been both internally administered and externally applied. When applied to an external wound, it sometimes causes almost immediate inflammation in the stomach, accompanied with violent vomiting and purging; and death is as likely to ensue as if the acid were internally administered. Whether, in this case, it is absorbed into the circulation, or the stomach is affected by sympathy, through the medium of the nerves, is still undetermined; but the probability is, that it is taken into the circulation, and acts directly on the organ, in the same manner as if it were swallowed. We have only, however, to consider its acrimony as an external application, to be satisfied that it exerts, also, an immediate and direct influence on the nerves of the stomach, when it is taken into that viscus. Upon the whole, therefore, although Arsenious Acid and its preparations, when properly administered, often afford all the advan-

* The word *Arsenic* first occurs in the writings of Avicenna.

tages which can be expected from the operation of the most powerful and safe Tonics; yet much caution is requisite in using them, under every circumstance.

When an overdose of Arsenious Acid or of Arsenite of potassa is swallowed, the first symptoms are violent pain in the stomach, and, soon afterwards, in the bowels also, accompanied by a sensation of heat and constriction in the œsophagus and the mouth, producing nausea with an increased excretion of saliva. These feelings are conjoined to a sensation of tightness of the skin of the face, stiffness of the eyelids, inflammation of the conjunctiva, and an itching of the face and neck. Vomiting is sometimes incessant; the fluid brought up is streaked with blood: there is purging, and occasionally a paucity of urine, and even strangury: the pulse, which is at first indicative of high inflammatory action, quickly sinks, and becomes irregular; cold sweats supervene, with convulsions, and death ensues. In those cases in which the poison has either been ejected or removed from the stomach, the wretched sufferer seldom fails to feel its influence during the remainder of his life, which is dragged on in mental and bodily debility.

The post-mortem examination of the body of a person poisoned by arsenic exhibits remains of inflammatory action in the stomach, generally confined to the mucous membrane, which is red, soft, pulpy, and easily detached; sometimes there is only a thinning of the coats: but more frequently there is a highly injected state of the vessels, with spots of extravasated blood. The inflammation of the stomach is often more severe, and the death more sudden, when the acid is applied to a wound, than when it has been swallowed: it is, therefore, supposed that the fatal issue is not the result of the local action of the poison on the stomach. Several ingenious experiments of Sir B. Brodie seem to confirm this opinion, and to lead to the conclusion, that death from poisoning with Arsenic is to be ascribed to its influence upon the heart and the nervous system: nevertheless, the decided change which it produces upon these is sufficient evidence of the energy of its local influence.

In such cases, undoubtedly, the first object is to free the stomach from the poison as completely and as quickly as possible, by the stomach pump, which should be promptly used; and I am of opinion that, if the nature of the poison be known, in using the pump, lime water should be employed to wash out the stomach instead of common water. The union of lime and arsenious acid forms a nearly insoluble salt; so that, whilst we are relieving the organ of its deleterious contents, we are, by using it, also diminishing the virulence of any portion of the poison which may remain. When, however, the stomach pump is not at hand, emetics—namely, sulphate of zinc or of copper, which

act directly upon the stomach, and not through the medium of the circulation,—should be administered. In this case, also, lime water should be drunk immediately after the first act of vomiting, to neutralize and diminish the activity of the Arsenious Acid in the stomach. It might be supposed that lime water, in this instance, should be administered in a tepid state; but it must be recollected that the solubility of lime is in the inverse ratio of the temperature of the water; and, therefore, by heating the lime-water, a certain quantity of the lime is thrown down, and the influence of the solution in neutralizing the arsenious acid is diminished. For although the arsenite of lime be not wholly insoluble, yet, it is less so than arsenious acid; consequently, its activity being in the direct ratio of its solubility, the formation of this salt in the stomach by the lime water is a safeguard, to a certain extent, against the acrimony of the arsenious acid. As there is hazard, should the arsenical salts be absorbed, we must be particularly cautious not to dilute with any fluid that is likely to act as a solvent of arsenious acid; such, for example, as alkaline solutions, which have been recommended in these cases; the alkaline arsenites being very soluble, and as poisonous as arsenious acid itself. Oil may be safely and advantageously administered, and also milk: the influence of oil is indeed so well known, that the smelters of metallic ores containing arsenic, in Cornwall, whenever they are infested with more than an ordinary portion of arsenical vapour, have frequent recourse to olive oil.

It is important to be prepared to ascertain the existence of the poison in solution, or in any food found in the stomach of a person supposed to be poisoned by it. The simplest mode is to throw the suspected fluid into Marsh's apparatus, and obtain impressions on glass or on porcelain; or employing a tube with a knee to carry off the Arseniuretted-hydrogen, and to place the flame of a spirit lamp under this, about two inches from its orifice; if Arsenious Acid be present, metallic Arsenic will form in the tube. When the quantity is small, it is preferable to pass a stream of sulphuretted hydrogen through it, to collect the precipitate, and adding to it some dry black flux, to reduce it to metallic Arsenic in a reducing tube. The Metallic Arsenic may be again oxidized; and being then dissolved, the solution may be tested with Ammoniacal Nitrate of Silver, which will throw down a lemon-yellow Arsenite of Silver; and with Ammoniacal Sulphate of Copper, which will throw down Scheele's green.

From what has been said regarding the absorption of Arsenious Acid, the employment of antidotes offers but little hope of benefit. It has been recommended to use vinegar; but the solubility of arsenious acid in vinegar renders this a dangerous agent; the sulphuret of potassa merits no better confidence, the sulphurets of arsenic being poisonous; but Ferugo, the hydrated

sesquioxide of iron has been found by experience to be an excellent antidote. It must be given in large doses. It is of great importance, after evacuating the stomach, to allay the excitement which has been induced on its coats; this is most effectually done by blood-letting: counter-irritation, as, for instance, blistering, by means of boiling water on the scrobiculus cordis; and sheathing the organ itself by the administration of oil and milk. When the inflammatory symptoms are reduced, the case is to be treated as one in which the stomach has been the seat of inflammation, without any reference to the exciting cause. The dose of Arsenious Acid is $\frac{1}{16}$th of a grain.

CHLORINE.

Chlorine operates as a *Tonic*, both in its gaseous form and in combination with other bodies. In the simple state, dissolved in water, it has been advantageously administered in malignant sore throat, in the low stages of confluent smallpox, and in other diseases in which it has been necessary to employ powerful tonic means. The saturated solution, for the preparation of which a formula is given by the Edinburgh and the Dublin Colleges*, is nearly colourless, has a harsh, styptic taste, and exhales the odour of Chlorine. It contains about twice its volume of Chlorine; and may be exhibited in a mixture consisting of half a fluid drachm to two fluid drachms, in eight fluid ounces of water, sweetened with a little syrup, the whole of which should be taken, in divided doses, in the course of the day.

B. EXCITANT TONICS, OPERATING THROUGH THE MEDIUM OF THE NERVES.

* *Ponderable Agents.*

a. Black Pepper. *Piper nigrum.* L. E. D. Long Pepper. *Piper longum*, L. E. D.—The plants which yield these peppers have been already described (p. 82); and also the alkaloid, Piperina (p. 563), which is one of its active principles. The combination of that with the acrid volatile oil, which these peppers also contain, in the powdered fruit, operates topically on the nerves of the stomach as an excitant tonic. On this account they are, in many instances, useful as stomachics, and, when medicinally administered, display an antiperiodic property, and arrest ague.

The dose of the powder of either Pepper is from gr. v to gr. x: in large doses, they operate as irritant poisons.

b. Coffee. *Coffeæ Arabicæ fructus.*—The Coffee plant is a native of the low mountains of Arabia Felix and of Abyssinia; and belongs to the natural order Cinchonaceæ†. It is a shrub

* Chlorinei Aqua, E. D.

† Fothergill's Works, ii, 279, t. 3. Richard, Hist. Nat. Med. ii, p. 281. Lindley, 440.

with oblong lanceolate leaves, acuminate, wavy, deep-green and shining on the upper disk, pale-green on the under. The flowers, which are white and sweet-scented, are tubular-funnel shaped, with a 4-5 parted limb supported on short axillary peduncles. The fruit is an oval, deep-purple, succulent, two-seeded berry. The seed, which forms what is termed the Coffee-bean, is too well known to require description.

The chemical nature of Coffee has been examined by M. de Cadet Gassicourt*, Seguin†, and MM. Robiquet and Boutron‡. They found it to contain a *fixed, white, fusible, sweet, inodorous oil*, a *concrete volatile oil, albumen, mucilage*, a *bitter principle*, an *acrid coloured oleo-resin*, and a crystallizable resinoid, which has been named *Caffeine*. The roasting of the Coffee develops tannic acid, and a peculiar acid, the *Caffic*. The tonic influence depends on the Caffeine, which varies in different varieties of Coffee grown in different parts of the world. Robiquet found it most abundant in that of Martinique, and least in St. Domingo Coffee§. According to Pelletier, Caffeine is procured by treating raw Coffee bruised with alcohol, which is distilled from the tincture, and the residue acted upon with water to dissolve out the Caffeine from the fatty matter taken up by the alcohol. The aqueous solution is then mixed with magnesia, and the filtered fluid evaporated to the consistence of a syrup, and then treated with alcohol, which dissolves out the Caffeine, and leaves a mucilage with which it was combined. By spontaneous evaporation, the alcoholic solution yields the Caffeine in crystals. Six pounds of Coffee should yield 90 grains of Caffeine.

Caffeine is in beautiful, long, flexible, silky, acicular crystals, neither alkaline nor acid, sparingly soluble in water, but soluble readily in alcohol. They melt at a low heat, and in close vessels sublime unaltered. According to Pfaff and Liebig, they consist of 49·96 of Carbon, + 5·74 of Hydrogen, + 16 of Oxygen, + 28·3 of Nitrogen, = 100·00; ($C.^8$ $H.^5$ $O.^{16}$ N^2) equiv. 210·26.

Coffee, as a beverage, appears to have been first used in Persia; and afterwards introduced into Turkey by Selim, after his conquest of Egypt. It was so intemperately drank in Constantinople in the 16th century, that its use was prohibited by the Mufti; but Solyman the Great again permitted it. It was introduced into England by one Edwards, a Turkey merchant, and sold at four and five guineas a pound. The cultivation of the plant rapidly spread to the West Indies, and it is now raised in many parts of the world, within the tropics. The best Coffee, in point of flavour, is that of Moka, but it is not the richest in Caffeine.

In roasting Coffee, its aroma is developed, and its bitterness augmented. The oil, upon which the former depends, is so

* Ann. de Chim. t. viii, p. 266 † Ibid. xcii, p. 5.
‡ Journ. de Pharm. Mars 1837. § Ibid. p. 109.

volatile, that Coffee kept exposed to the air, soon loses all its flavour. Coffee yields its active principles to both cold and hot water, but the latter is generally preferred for domestic use. As an excitant tonic, Dr. Grindel, in Russia, used it in the unroasted state, in the form of powder, in doses of ℈i, repeated at moderate intervals, in agues, with decided advantage; and a decoction of raw Coffee is eulogized by Dr. Amati of Naples, in the treatment of chronic ophthalmia. He administers it internally, and applies the Infusion topically as a lotion.

CHAMOMILE FLOWERS. *Anthemis*. L. E. *Anthemis nobilis*. D.—Nothing remains to be added to the account already given of these flowers (p. 565), except that they operate as an excitant tonic on the nerves of the stomach. The single flowers are preferable, the piperina and volatile oil being chiefly contained in the tubular flowers.

CASCARILLA BARK. *Cascarilla*, L. E. D. (p. 45).—The combination of the volatile and bitter extractive in this bark enables it to operate beneficially as an excitant tonic: but it is contra-indicated when any degree of inflammation is present. It may be administered either in the form of Infusion or of Tincture.

INFUSION OF CASCARILLA, *Infusum Cascarillæ*, L. E. D. is made with ℥iss of the bruised bark, and Oi (℥xviii, D.) of boiling distilled water. The dose is f℥iss to f℥iv.

TINCTURE OF CASCARILLA, *Tinctura Cascarillæ*, L. E. D. is made with ℥v (℥iv, D.) of the bruised bark, and Oii (lb. ii by measure, D.) of proof spirit, either macerated for fourteen days and filtered, or passed through the pecolater. The dose is fʒi to fʒii. It is an excellent aromatic addition to simple tonic infusions.

CUSPARIA BARK. *Cusparia*. L. E. *Angusturæ Cortex*. D. (p. 46).—The same remarks which I have made on Cascarilla as an excitant tonic, apply to this bark: but it is more directly stimulant than the Cascarilla; on which account it is more useful in the debility which is a frequent sequel of many febrile affections. In atonic dyspepsia, the combinations of tonic and excitant properties in Cusparia is of the utmost advantage.

INFUSION OF CUSPARIA, *Infusum Cuspariæ*, L. E. D. is made with ʒv (ʒii, D.) of the bruised bark, and Oi (lb. ss, D.) of boiling distilled water: infused for two hours and strained. The dose is f℥i to f℥iv.

TINCTURE OF CUSPARIA. *Tinctura Cuspariæ*. E. *Tinctura Angusturæ*. D.—To make this Tincture, we are directed to take ℥ivss (℥ii, D.) of the bark in moderately fine powder; and Oii (Oii old wine measure, D.) of proof spirit; and to make the tincture either by percolation or by maceration for fourteen days and filtering. It is a powerful preparation; and it may be administered in doses of fʒss to fʒii, in any simple bitter.

MYRRH. *Myrrha*. L. E. D.—Although few articles of the

Materia Medica have been so long known and used as Myrrh*, yet the plant producing it was unknown until 1820, when it was discovered by Ehrenberg, at Beit el fakip, near Gison, on the borders of Arabia Felix. It belongs to the natural order Burseracea. The plant is termed Balsamodendron *Myrrha* by Ehrenberg†, the name adopted by the London and Edinburgh Colleges. Professor Lindley describes it under the name of Protium *Kataf;* but there are doubts as to its identity with the Balsamodendron *Kataf* of Kunth. It is a low shrub, with spiny branches and ternate leaves, with the terminal leaflet large. The fruit is globular, with a drawn-out point. The Myrrh exudes from cracks in the bark.

Myrrh is imported in irregular pieces, about the size of a small walnut, of a dull, pale, brownish-red externally, often tuberculated, breaking with a vitreous fracture, and easily powdered. Its odour is peculiar, and rather agreeable, its taste bitter and slightly aromatic when fresh pulverized, and not disagreeable. It feels fat and greasy under the pestle, owing to the volatile oil adhering to its resin. It is not fusible, and not easily inflamed. Its sp. gr. is 1·360. When the masses are dark-coloured, and have an unpleasant odour, the drug is bad. The best Myrrh adheres to the teeth when chewed, and renders the saliva milky. It is partially soluble in water, forming with it an opaque, yellow solution; but nearly one third of the suspended matter is deposited by rest. Alcohol takes up the portion insoluble in water, and forms a tincture, which water renders opaque and whitish. The other portion, soluble in water, resembles Tragacanth or Bassorah gum‡; it is slowly precipitated by bichloride of mercury and diacetate of lead, and combines with the oxides of these salts: it also acquires cohesion, and becomes nearly insoluble when evaporated to dryness. Myrrh is soluble in the alkalies; when it is distilled, a heavy fixed oil is procured: nitric acid changes it to oxalic acid. According to the analysis of Pelletier, Myrrh is composed of Resin, combined with volatile oil, 34·68 + gum, and traces of salts 65·32, = 100·00. The resin, deprived of the volatile oil, is tasteless and inert§; and only partially soluble in ether.

* "And they lifted up their eyes and looked and behold a company of Ishmaelites came from Gilead with their camels, bearing spicerie, and balm, and Myrrh, going to carry it down to Egypt."—Genesis, chap. xxvi, v. 25.

† De Candolle, prodr. ii, 76. Nees von Essen. Plant. Med. t. 357. Lindley, 170.

‡ "Vauquelin, when treating the root of a species of grass from Arabia, the Anthropogon *Schœnanthus*, obtained an oil from it, of a sharp taste and peculiar odour, not unlike that of Myrrh. He ascertained that, when this oil is united to gum or mucilage, it forms a compound closely resembling natural Myrrh.

§ Myrrh was used for various purposes by the ancients. According to Plutarch, in his Dissertation de Isse et Osire, it entered into the composition of the famous *Zulphi*, which, it is stated, inflamed every night to the setting sun, in the temple of Vulcan, at Memphis. Its medicinal use, both externally and internally, is mentioned

Myrrh is a stimulant Tonic, determining to the surface, and well adapted, when exhibited in powder, for the relief of humid asthma and chronic catarrh. The watery solution, in combination with nitrate of potassa, foxglove, opium, and camphor, or sulphates of zinc, or of iron, is often administered in phthisis; but it is only by the use of the gum-resin alone, in the latter stages of that intractable disease, that it can, in any way, prove beneficial. Myrrh, in this case, acts as a Tonic, and arrests, in some degree, the progress of that exhaustion which always accompanies purulent expectoration. For the same reason, it proves beneficial in chlorosis, and defective flow of the menstrual discharge, in pale, leuco-phlegmatic, languid girls. In combination with oxide of zinc, it has been found beneficial in a peculiar cough which occasionally accompanies pregnancy, and continues after abortion. Upon the whole, I may assert that Myrrh possesses tonic powers; but that these can be taken advantage of only in cases where stimulants are required. It may be administered in powder, in combination with sulphate of potassa; or in pills, in combination with other Tonics; or in the form of watery infusion; or of tincture, if properly diluted. The oil, mixed with sugar as an oleo-saccharum, possesses all the properties of the entire drug. The dose in substance is from gr. x to ʒi.

Tincture of Myrrh, *Tinctura Myrrhæ*, L. E. D. is made by digesting, or by percolation, ℥iii (℥iiiss, E.) of bruised or powdered Myrrh, in Oiiss (Oii, E.) of rectified spirit. The dose of the tincture is from m. xxx to fʒi in f℥ii of water. The watery emulsion is useless; being merely a solution of gum, slightly impregnated with the bitter of the Myrrh.

Rhizome of Sweet Flag. *Acorus*. L. *Calamus aromaticus*. E.—The physical characters of this rhizome and the properties of its volatile oil have been already described (p. 40); what share this oil has in its tonic power is not so obvious. In the fenny counties, and in Holland, its influence in curing agues is well known; and I regard it as one of the best additions which can be made to any of the more simple Tonics in the treatment of intermittent fever. I have seen both the bark and the disulphate of Quina succeed in curing the disease when combined with the Acorus Calamus, in powder, although they had previously failed when administered alone. Whether the volatile oil, which is now produced in a separate state, if administered as an oleo-saccharum, in combination with disulphate of Quina, would be productive of the same beneficial effects as the powdered rhizome, I have not yet ascertained. The best form of administering it is powder, in doses of ℈i to ʒi.

by Celsus and other early authors; and the *Vytians*, the native practitioners of India, order it as a cordial, and externally, mixed with lime juice, as a repellent.

* * *Imponderable Agents.*

COLD BATHING.—It is well known that water applied to the surface acts as a Tonic when its temperature is above 40° or below 70° of Faht.: and, although it be applied to a small portion only of the surface, yet its effects extend first to the whole surface, and then to the entire vascular system: a sensation of cold is immediately felt; but, if the application be transitory, reaction takes place, and the heat is soon recovered. When any person is immersed in water at 60°, the first effect is general condensation of the body; rings fall off, the skin becomes pale and rough, like goose skin, and sometimes there is even chattering of the teeth. On emerging from the water, however, if sufficient energy of the system exist, a sensation of warmth supervenes, the skin reddens, the action of the heart is increased in vigour, and a genial perspiration soon breaks out over the skin. We explain this by saying, that, when a stimulus is suddenly abstracted from the living system, the facility of excitement is increased, and the slightest excitant produces a greater effect than could have existed before such abstraction. When caloric, therefore, is abstracted from the body, as during its immersion in cold water, the action of the cutaneous vessels is lessened, and a small quantity of caloric causes greater excitement than usual; hence, the glow and general warmth felt on the returning flow of the blood to the surface; and this continues until the excitability is restored to its natural equilibrium. Tone consists in a due degree of vigour in the muscular system, particularly the heart and arteries: by the reaction, therefore, which takes place after Cold Bathing, tone is as it were propagated over the whole system: the stomach first experiences it from the peculiar sympathy of that organ with the surface; the digestive powers are thereby augmented, a tendency to plethora is induced, and cheerfulness and vigour of mind follow. This reaction is always excited in a degree proportionate to the force of the living powers, and to the intensity of the cause which called it into operation. The system makes a powerful effort to overcome the sudden and general impression made on the sentient surface; hence an increase of animal heat takes place, when the blood, which was suddenly repelled from the surface, again returns to it. It is not, however, the abstraction of heat from the surface, by a cold medium, that causes this reaction; it is the sudden application of the cold medium to a large extent of surface. If a person continue too long in the cold bath, the effort necessary to generate an unusual quantity of caloric in the system tends to destroy the animal powers.

Sea-Bathing.—Part of the tone induced by sea-bathing is due to the nature of the medium. Sea-water is denser than fresh water; and the greater the density of the fluid, the more stimulant are the saline particles left on the skin as the aqueous particles evaporate. No absorption takes place; the effect on

the surface is propagated to the whole system by that nervous sympathy to which we are forced to attribute the general tonic influence of substances that exert a primary influence on the nerves of the stomach.

Fresh-water cold bathing is more or less Tonic, according to the degree of temperature at which it is employed. When at 48° and 50°, which is the temperature of most fresh water springs, the degree of cold is so intense that it acts as a sedative, and is followed by shivering, headache, drowsiness, loss of apetite, and general debility. In many persons this effect is the constant result of cold bathing, whether in the sea or fresh water, even at a medium temperature. Such individuals should either not bathe at all, or they should previously fortify the system, either by a hearty breakfast, or by taking wine, or by exercise. When the patient feels the shock of the immersion very severely, when no glow succeeds, and when symptoms appear indicating that the reaction is not equivalent to the contrary impression on the surface of the body, then the Cold Bath is invariably productive of harm.

The term cold-bathing, besides implying the immersion of the body in water, also comprehends the use of the *shower bath*. This is equivalent to the effusion or dashing of cold water over the body; as a Tonic, it is employed at the same temperature as the cold bath. It is more efficacious if salt be added to the water.

In weak and delicate frames of body, such as often present themselves in females, I have seen much advantage derived from the continued use of the shower bath throughout the year: but, in such cases, it is necessary to begin with water at a higher temperature than that of the atmosphere at the time.

Exercise.—When we contemplate the number and power of the moving organs of the body under the control of the will; the strength of the extensor and flexor muscles, and the facility with which, by their aid, locomotion is produced; few arguments are required to convince us that a state of constant rest is unnatural; and that motion or exercise is essential for the maintenance of health. Exercise, therefore, may be regarded rather as a prophylactic Tonic, than one actually adapted for the removal of disease. But Exercise, employed to restore the vigour to the habit debilitated by disease, has a claim to the appellation of a direct Tonic. It aids in circulating the blood more equably, promoting especially the action of the capillaries and the function of the skin.

Amongst the various kinds of Exercise in general use, *walking* is the best, when the strength of the body admits of a moderate degree of fatigue with impunity. It throws into action not only the muscles of the lower limbs, but those of the arms and several of the largest and most important of the trunk; particularly those which, fixed in the loins, serve as flexors to the thighs. It is probable that the motion of these

contribute, in some respects, to aid the peristaltic movements of the intestines, and thus to favour that regularity of the excretory function of the abdominal viscera, without which health cannot be preserved. When walking, in a convalescent, causes difficulty in breathing, palpitation, or pain in the region of the heart, it should be discontinued; but, when it is performed with ease, it should be continued nearly to the point of fatigue, which may be greatly extended by diverting the mind with a succession of new objects, or the conversation of a lively companion.

Horse Exercise requires greater power of muscles than can be expected in early convalescence; but, as it engages the upper part of the body, and occupies the arms and large muscles of the chest, which influence the motion of the lungs, it is most important as soon as it can be borne. In taking Horse Exercise also, something is due to the extent through which the person passes in the open air, and the engaging of the attention by the scenery; for experience has demonstrated that mere Horse Exercise, taken in a riding school, or within a limited space of ground, is not so salutary as riding in the open country. As a prophylactic, in those predisposed to Phthisis, riding has been justly extolled; and, even when the disease has displayed itself, if, as Sydenham remarks, it be "without fever or ulcer," riding may be regarded almost as a specific; although we cannot accord in the opinion of Desault, that it tends to break down the tubercles, and to remove the accompanying obstructions of the liver; nor enter into the views of Salvidori, who directed his patients in the morning to climb some eminence till out of breath and bathed in sweat. I have often witnessed the beneficial effects of Horse Exercise in frames of body greatly weakened by asthma; and have seen individuals who were scarcely able to mount on horseback, return from a ride vigorous and alert; and, by the daily renewal of this exercise, rapidly regain a degree of vigour and tone which could scarcely have been anticipated. When Horse Exercise or walking cannot be resorted to, the next best is Carriage Exercise or Sailing: but it must be recollected that scarcely any of the influence of these can be referred to the muscular system.

It is unnecessary to extend these remarks. The Exercise of convalescents, particularly those who have suffered from acute diseases, should not extend beyond certain limits. It may be continued up to, but certainly not beyond, the point of fatigue: in attending to this circumstance, also, we ought to be aware that rest is not always the best method of relieving the uneasy sensation and apparent exhaustion which occur after immoderate exertion, in some states of the body; for these are often more readily dissipated by changing the nature of the exertion than by actual rest. At the same time, much danger

may result from acting too long upon this principle: for, as the mere stimulus of a change must be regarded as purely mental, the exhaustion of the corporeal powers, when the exertion is over, is so great as sometimes to be productive of the most dangerous consequences. The degree of Exercise, therefore, which the body can sustain with impunity, is not always to be regulated by the sensation of the fatigue which it induces, but by closely observing the extent to which the character of the frame, its muscular energy, and the actual powers of the constitution at the time, taken together, authorize its continuance.

b. Friction may be regarded as a species of exercise, and its effects explained on the same principles. To produce a tonic effect, it ought to be brisk, and performed in such a manner as to cause a degree of redness and warmth on the surface, and over a large portion of the body. The ancients judiciously employed Frictions after tepid bathing, and aided its influence by the administration of wine and water during the intervals of the rubbing. On this principle only can be explained the beneficial effects of the Oriental fashion of shampooing, which has been properly introduced into this country. In phthisis, the pains of the thorax are often relieved by Friction; and the influence of percussion, which may be considered a variety of Friction in chronic rheumatism, has been fully discussed. It may be rationally enquired, whether any advantage is derived from aiding the Friction by stimulating embrocations of oils? If the Friction be well performed, and for a sufficient length of time, nothing of this kind is necessary. It is only when a narcotic impression is to be added to the influence of the Friction, that embrocations are really useful. How far Friction may owe its salutary influence to electrical agency, is a subject well worthy of examination.

c. Mental Powers.

The first of the Mental Tonics is Hope: let us enquire in what manner it operates as a Tonic?

A Tonic we know is a stimulant, of a degree inferior to that which would produce a state of collapse; and it must be applied in such a manner as shall keep up and render permanent the impression which it is capable of producing. Now, Hope operates in this manner in many diseases. This is particularly illustrated in *Nostalgia*, a disease which is common to the Swiss, the Scotch, and other mountaineers, when in a foreign country, if circumstances occur to awaken associations connected with the delights and enjoyments of their early years at home. This disorder, which is ushered in by great depression of spirits, melancholy and languor, deep sighing, trembling of the limbs, and other symptoms, not unlike those of phthisis, would prove

fatal in a short time, were the hope of returning home not lighted up in the mind. Hope, in this instance, operates exactly as a material Tonic; it increases the energy of the heart and arteries; improves the secretions; and not only sustains the powers of life, but fortifies those tissues which are organically affected in this disease against the morbid action that would otherwise be induced in them and lead to a fatal termination. That such morbid states occur, has been demonstrated by the post-mortem examinations made by Dr. Avenbrucker, who had many opportunities of seeing the disease in the Spanish hospital at Vienna. This physician observed, that, in several persons who died of Nostalgia, the lungs were affected; that some parts of them were adherent to the diaphragm; in other parts they were indurated, or were even more or less ulcerated. The tonic influence of Hope in removing this disease is well known, and it is a powerful agent in the hands of a judicious physician. If two physicians treat the same disease with similar remedies, and with equal skill; yet, if one of them look grave and anxious before *his* patient, and drop hints that some uncertainty is connected with the result of the disease; whilst the other holds up to *his* patient the prospect of recovery, assumes a cheerful and confident expression of countenance before him, veiling every doubt that may hang upon the future, and directing the eye of the sick man to every enlivening ray that beams upon it; the certainty of success is more likely to follow the treatment of the latter than that of the former of these practitioners. "In dangerous maladies," says an able physician, "the person in whom there is the least fear of dying, has, other circumstances being the same, the fairest chance to survive; and, in this manner, Hope, aiding the efforts of Nature, gives an efficacy altogether unexpected to the medicines employed. Tell a timorous man, who has been in the habit of looking up with reverence to the opinion of his physician, that he is in danger, it may probably kill him: but let the doctor pronounce the sentence, with sufficient decision and solemnity, and, under certain circumstances, it will execute itself." In every case, therefore, in which Tonics are admissible, we may take advantage of Hope, as an exciting agent, which tends to increase the power of others upon the system, and which, when *properly applied*, rarely disappoints our expectation.

2. *Confidence.*—On the same principles as Hope, Confidence operates as a tonic power; nothing is, therefore, of greater importance to the practitioner than securing the confidence of his patient, in order to insure the success of his practice: how is this to be effected? The first step for obtaining the command of so powerful a weapon against disease, is the mode of investigating the cause of disease. An inquisitive physician, who examines minutely into the usual habits, the exercise, regimen,

sleep, and state of excretions, or whatever in any degree can have contributed to alter the health of the patient, as well as the state of the functions of the body itself, in such a manner as demonstrates an intimate acquaintance with his subject, is certain to attain that control over the mind of his patient which alone can secure his confidence both in himself and in the means which he employs; and, having done so, like an intelligent general, who knows the value of his troops, he can rely with security on the results of the measures which he adopts. As a tonic power, the influence of Confidence might be illustrated by a thousand examples: for instance, the empyric owes to it the few cures which he blazons forth as the recommendation of his nostrum; but, although it is the prop of the impostor, yet, like dew of heaven which falls equally on the just and the unjust, it is not the less valuable when properly employed by the scientific practitioner.

Were any thing requisite to prove the power of mental Tonics in disease, it would be only necessary to refer to their influence in sustaining the body under fatigue which could not otherwise be borne. What is it but Hope and Confidence which enable a mother, night after night, to watch at the bed-side of a sick infant?—to bear up, even with a weak and delicate frame of body, under fatigues which no stranger could sustain, and yet, if the object of her solicitude recover, to suffer no inconvenience from the exertion:—take away the tonic powers of Hope and Confidence, or let all her attentions prove unavailing and her infant fall a victim to the malady, then her health will give way, she will feel the exhaustion which naturally follows exertions too powerful for the strength of her body to sustain with impunity; and she may fall a victim of the anxiety and watching, under which Hope and Confidence had so long borne her up, and which could alone sustain her by their tonic powers.

Despair, indeed, in every instance where disease falls upon mortality, may be regarded as bearing the standard in the van of Death.

3. *Travelling* is also a mental Tonic; but it has a closer affinity with material Tonics than either Hope or Confidence. It is an undoubted fact that, however it is accomplished, the mind is so formed that certain impressions produced on our organs of sense, by external objects, are followed by correspondent sensations. Now, in what other manner does a material Tonic produce its effect, except that the sensation is communicated through the nervous extremities of the sentient organs of the stomach or of the skin, instead of those of the eye. The great advantage of Travelling, therefore, is the constant change of objects, the repetition of one salutary impression before the effect of a former is dissipated, until, as in the administration of a

material Tonic, the effect becomes permanent. In no disease is the advantage of the Tonic influence of Travelling more conspicuous than in Hypochondriasis. In this disease there are languor and torpor of the whole body, timidity and depression of the mind, and a general disordered state of the functions of the stomach and intestines. Medicines have little influence in relieving these symptoms; but by a change of climate and of scene the disease is mitigated, and often cured. Something, however, it must be admitted, is due to the state of the atmosphere, the temperature, and other physical properties, which distinguish one climate from another: but much more advantage is procured by moving from place to place, than by remaining stationary, even in the most favourable climate; and the salutary effect, therefore, can only be ascribed to the mental excitement produced by the constant change of scene.

It may be argued, that the depression of the mind in Hypochondriasis, as it depends on a weakened state of the digestive organs, might be removed by whatever gives tone and vigour to these parts, independent of mental impressions. But this mode of reasoning is more specious than solid: many examples occur in which these organs are greatly diseased, and yet no Hypochondriasis follows; there is, therefore, some state of the nervous system which may suffer greatly from disordered functions in particular organs, but which, as it cannot be regarded as depending on these derangements, so it cannot be removed by their removal. Some predisposition must exist in the nervous system, or in the mind itself, before such functional disorders can produce Hypochondriasis. We know that no set of men are so liable to this disease as scientific and literary men. This has been attributed to their sedentary habits; but much is due, also, to the excitement which they experience being unvaried; as the disease most frequently occurs in those who turn their attention into one line of investigation, or to the prosecution of one branch of science. We know well the force of habit when the abuse of material excitants has been long indulged in; as, for example, opium; and the little impression which, in such cases, even the largest doses produce on the nervous energy: in the same manner, the constant application of the same mental excitants ceases to rouse the energies of the intellectual principle; and the body suffers in the general apathy which follows—the motion of the blood languishes; the surface is deprived of its requisite supply; the stomach and the intestines, from a consent of these with the state of the mind, are debilitated; congestion in the arterial trunks and on the larger vessels succeed, and Hypochondriasis is firmly established. It is not wonderful, under these circumstances, that the functions of so important a gland as the liver should be disordered; and hence we find that the most common accompaniment of Hypochondriasis is

imperfect bile. It is true that this disease is sometimes the effect, not the cause, of such a vitiated secretion; but the same circumstances which operate in the production of the one, are likely to influence the other. If this account of the disease be correct, it is evident that the torpor of the mind may, at least, be regarded as a great part of the malady: whatever, therefore, can produce new impressions adequate to excite the attention, must prove useful; and excitants of a mental kind, even although at first irksome and troublesome, yet, if they be sufficient to occupy the attention and to lead to a new series of ideas, cannot fail to prove beneficial. It is on these grounds that Travelling operates as a Tonic in Hypochondriasis; and even in all diseases of debility, if the fatigue be apportioned with judgment to the power of sustaining it. In prescribing Travelling as a Tonic, it is surely unnecessary to say, that countries ought to be recommended most fertile in those circumstances which are likely to rouse the curiosity and arrest the attention. "Cœlum," to use the words of the most elegant of writers of modern medical Latin, "patrio pulchrius, mores festiviores, et scænæ novæ et amoenæ, mentem grate occupant, et imaginationem suavissime detinent*."

Having dilated so much on the effects of Travelling as a Tonic, it is unnecessary to enter into any details on the tonic influence of *Amusement.*

Therapeutical Employment of Tonics.

The class of diseases for which Tonics are most frequently prescribed are those of the *digestive* organs: and on this account the term *stomachic* medicines is synonymous with that of *Tonics.* Before noticing the manner in which Tonics operate in relieving *indigestion*, let us understand in what that diseased condition of the stomach depends.

Every morbid affection of the stomach will, more or less, impede digestion; but, in general, *Atonic Indigestion* implies that condition of the organ in which it either ceases to secrete, or secretes imperfectly, the fluid destined for the solution of the food, namely, the *gastric juice;* whilst, at the same time, the organ, if not in a state of simple atony, is in such an excitable condition, that the food causes painful sensations and irregular movements. The uneasiness thus produced is usually referred to the *nervus vagus;* but, as the whole nervous system is sympathetically affected, it may be partly referrible, as Müller has remarked, to "an impression made on the sympathetic nerve†." During the digestive process, there is

* Gregory De Morbus Cœli Mutatione Medendis Diss. Inaug.
† Elem. of Physiology, Trans. p. 485.

no attrition of the food; but the observations of Dr. Beaumont have demonstrated that the stomach is contracted and undergoes various movements: in its state of *atony*, these are necessarily *defective*. It is in *atonic* dyspepsia, therefore, after removing crudities and diseased secretions from the stomach by an emetic, and also carrying out of the intestines indigestible matters lodged in them, that the administration of *Tonics* proves beneficial. They are employed both to relieve urgent symptoms and to effect a salutary and a permanent change. Two descriptions of Tonics are indicated to fulfil these intentions: 1, those of an immaterial character, calculated to excite the function of nutrition, by proper exercise of body and mind: 2, those of a material kind, adapted to give *tone* to the relaxed and debilitated tissue of the organs in fault.

Exercise comprehends those movements of the body which bring all the members more or less into motion, diffusing and aiding the circulation of the blood to every part of the frame, especially to the surface, so as to produce, according to the strength of the patient, a greater or less degree of perspiration. In the acute form of atonic dyspepsia, the feet and the hands are cold, there is a general feeling of chilliness over the skin; and sometimes a particular coldness, stiffness, or numbness of the fingers; in the chronic variety, the skin is either dry and harsh, or it is moist and clammy; sometimes cold; and perspiring on the least exertion. There is an inaptitude for exercise, frequent yawning and stretching, torpor in movements, which gradually acquire a great effort, and are accompanied with a sensation of fatigue and weariness almost amounting to pain; and the greatest sensitiveness of every change of weather, particularly of moist weather. Under such circumstances it may be readily conceived that sedentary habits would increase the evil: at the same time, the exercise should be suited to the strength of the patient, and consequently, at first, that which is least likely to fatigue. Indeed, even as the vigour of the body returns, exercise should never be carried to fatigue; and should always be accompanied by some object which can impart interest to it. Nothing, indeed, influences so beneficially the exercise of the body, during its performance, as the exercise of the mind. The functions of the nervous system, which supply the vital energy by which the process of organization is carried on, and the power by which intelligence and voluntary motion are performed, demand that both body and mind be simultaneously exercised. Exercise, employed as a *Tonic*, should always precede a meal; when it follows it, the digestive process is suspended, and the stomach feels loaded and suffers from distension. Two hours at least should intervene between a meal and exercise.

Although, as I have already remarked, nothing aids more

the tonic influence of Exercise than occupation for the mind; yet, when the mind is *long* and *intensely* occupied, it withdraws power from the nervous system, in the same manner as too long continued *corporeal* exertion exhausts the powers of the body; it, consequently, deranges the function of digestion. A total mental indolence, on the other hand, also deranges digestion, by the absence of the stimulus of pleasurable enjoyment, which mental occupation imparts. It is in consequence of a total inaction of the body, with a fatigued and exhausted state of mind, that the studious become dyspeptic; and, although a complete repose may not be advisable, yet studies should be varied, in order that the different faculties of the mind be brought alternately into exercise. Unvaried study fatigues and exhausts the mind; it is, therefore, requisite to vary our mental occupations, in order to maintain the health of both the mind and the body. When dyspepsia and hypochondriasis already exist, the mind is most effectually withdrawn from the morbid feelings which entail misery on the patient, by cultivating the practice of light composition. By thus cherishing the creative faculties of our minds, "the nervous irritability, the exquisite sensibility, the busy and restless worrying of the memory and imagination, will fade and retire, at the approach of their powerful antagonist, and ultimately abandon the field*." The influence of intense study in suspending the digestive function is well known; consequently all close application *soon after* a meal should be avoided: and, under every circumstance, a due quantity of bodily exercise should alternate with study; since study without this produces both inertion of body and sluggishness and indolence of mind. When exercise cannot be taken, friction may supply its place; and this is most effectually accomplished with hair gloves. Friction not only equalizes the circulation, but it excites the peristaltic action of the bowels, which in Dyspepsia should be carefully unloaded, but they should *never* be purged. At the best, friction, however, is an imperfect substitute for exercise: the constant renewal of air, the freshness of the morning breeze, the stimulus of new scenery, are all wanting to fulfil that indication for which exercise is so well adapted.

Travelling is another immaterial Tonic of the utmost importance in *atonic dyspepsia*, especially when hypochondriasm is engrafted upon it. The stimulus thus afforded to the mind operates in two ways; it withdraws the attention from the uneasy sensations of the body, and it gives an impulse to the arterial and the capillary circulation, by the repetition of moderate excitement to the nervous system, afforded by the new impression which every change of scene bestows. Such are the immaterial Tonics indicated in this variety of indigestion. The weakened

* Fletcher.

condition of the stomach itself, however, requires the aid of *material Tonics* to be applied to the organ, not only to restore its proper tone, but, through its means, to produce a salutary change upon the system at large. The medicinal agents comprehended in the second group of the first division of this class, those containing bitter extractive and volatile oil, a combination of bitters and aromatics, are undoubtedly the best adapted to fulfil these indications. It is necessary, however, to remark that their powers have been greatly overrated; a circumstance which has often led not only to their abuse, but to the exclusion of other means better adapted to the nature of the particular case. When Tonics of this description are indicated, there is a depraved and defective secretion of the gastric juice; a diminution of the absorbent powers of the whole alimentary canal, by which the digestion of fluid ingesta is rendered difficult; and a relaxed condition of the muscular fibres of the coats of the stomach, diminishing the contractile power of the organ, which is necessary for bringing the whole of its contents successively in contact with the solvent fluid. The infusions of Cascarilla, Chamomile, Orange peel, and Gentian in combination with the mineral alkalies, are well adapted to counteract that condition of the stomach: but the whole of the division is equally suited to restore the gastric energy, provided the organ be not suffering at the time from irritation. Nothing, however, equals those preparations of Iron which are contained in the chalybeate springs; and their efficacy is greatly enhanced by the absence from business, and the cares and anxieties attending it, which are the necessary consequence of drinking the waters of these springs at the fountain: a fact daily illustrated by the failure and disappointment which follows their use in towns, however carefully they may be transported, and however unchanged they may be in their chemical characters. If, however, the occupations of individuals prevent them from using these Tonics at their sources; the best substitute for them is the sesquicarbonate of Iron, prepared at the moment it is to be taken, and administered in small doses. This is easily procured by decomposing from three to four grains of the Sulphate of Iron in solution, by means of double the quantity of the bicarbonate of Soda, in a large quantity of water; or, what is a more agreeable chalybeate, from m. xx to m. xxx of the Tincture of the Hydrochlorate of Iron in half a pint of water, taken on rising in the morning, and followed by a brisk walk in the open air. It is rendered still more efficacious by the addition of some mild aperient, such as Rhubarb or the Extract of Aloës: with the application either of the shower bath, or the cold douche, with salt and water, to the region of the stomach; or to the back directly opposite to it. Sponging the whole trunk of the body with a moderately strong solution of salt in water, whilst the lower extremities are warm

in bed, proves equally efficacious. It would be out of place here to enter into the other parts of the treatment of atonio indigestion. As far as Tonics are indicated, the great object of the practitioner should be not merely to operate on the diseased organ, but to change all the habits of the patients, both *corporeal* and *mental.*

There exists, occasionally, a relaxed state of the intestinal canal, which is attended with *chronic diarrhœa;* and there is an opinion that this state is only to be corrected by a combination of *Astringents* and *Tonics.* If debility or loss of tone be really present, assuredly Tonics will prove beneficial; but we may rest satisfied that the number of chronic diarrhœas depending on that cause is comparatively few. Irritation or subacute inflammations are generally present; hence the use of Tonics is not indicated. The necessity, therefore, of enquiring closely into the condition of the mucous membrane before prescribing *Tonics,* is evident.

What I have already stated respecting the effect of inducing tone in dilatation of the heart, is sufficient to point out how far we may prescribe Tonics in that affection. In palpitation and irregular action of the organ, which are frequently symptomatic of gastric affections, their employment may prove very beneficial.

In some of the varied affections depending on morbid conditions of the cerebro-spinal centres, Tonics are undoubtedly useful. This is the case in some varieties of Hypochondriasis, especially those in which there is a sensation of weight at the stomach, after taking food, a total disinclination for food, or a loathing of it. The tonics indicated in this state of the digestive organ are the sulphates of Quina, iodide of Iron, and the sesquicarbonate of Iron, prepared in the manner I have already described.

In *gastralgia,* when it occurs two or three hours after taking food, causing a sensation of weight at the stomach, or a feeling of gnawing, or heat, or cramps, or pain in the organ, with oppression of breathing, Tonics prove highly beneficial. In this condition of the stomach there is no gastritis; the food is not rejected; nutrition and assimilation proceed as in health; and the fæces display a complete digestion of the alimentary matter. The appetite is good; but the repast is scarcely finished, ere the pain at the epigastrium commences. This is evidently a nervous affection, and must not be confounded with chronic gastritis, which is always accompanied with a disgust for food, difficult digestion, and diarrhœa. In *gastralgia,* the pain of the stomach often alternates with pains of the forehead, and other neuralgic feelings. The Tonic best adapted for this form of the disease is the Tincture of the Hydrochlorate of Iron in minute doses. The use of the remedy should be occasionally

intermitted; and the dose gradually augmented. When gastralgia assumes the form of *pyrosis*, no Tonic proves more serviceable than the Trisnitrate of Bismuth.

It is scarcely necessary to remark, that all the medicines of this class are contraindicated when the condition of the intestinal canal, connected with Hypochondriasis, borders on *gastro-enteritis*.

That the symptoms of *Hysteria* may be occasionally referred to a depraved state of the stomach and the rest of the alimentary canal, is rendered evident by distension of the upper part of the abdomen, a sensation of weight after eating, which is accompanied with inability to move, with cold hands and feet; and by prolonged constipation, or the opposite states—namely, obstinate diarrhœa. In such a condition of the habit, medicines of a nature to augment tone will be found to diminish the susceptibility of the nervous system to impressions calculated to excite the hysteric paroxysm: but their operation must be watched, for they not unfrequently produce headache and febrile excitement. Perhaps in no cases are the mineral acids more useful as Tonics; they may be given in doses of ten or twelve minims of the diluted acids of the Pharmacopœias in infusion of confection of roses, aromatized by the tincture of cinnamon, musk, or valerian. In many instances, light infusions of calumba, cascarilla, or acorus calamus, prove useful: but the objections of hysterical patients to all bitters is a great obstacle to their administration. The chalybeate Tonics, when indicated, may be administered in small doses, without any sacrifice of their good effects: to a draught, containing eight or ten minims of diluted sulphuric acid, we may add half a grain of sulphate of iron; or it may be given in a pill, in combination with some bitter extract. A still smaller dose may be given, with equal advantage, of the tincture of hydrochlorate of iron; and, when the bowels are indolent, this may be most beneficially combined with the compound aloëtic decoction. The new power which we now possess in the iodide of iron, has supplied a great desideratum in the treatment of this form of Hysteria: it not only allays morbid susceptibility by augmenting tone, but it renders this permanent, by the improvement which the iodine produces in the secretions. It has been regarded as an objection to the idea that iodine is the agent in effecting this change in the secreting organs, because the fluid state in which this medicine must necessarily be administered, changes the iodine into hydriodic acid, and the preparation into a hydriodate. I need scarcely say that this is a mistake; that the compound in the aqueous solution is still an iodide.

If small doses of *these* active chalybeates prove salutary Tonics in Hysteria dependent on debility, large doses of the ordinary *sesquioxide* or *carbonate of iron* are by no means suited

for this form of disease. Chalybeate springs in our own country were, at one time, much resorted to for the relief of Hysteria; but this is now discontinued; a circumstance which may be explained either by the abuse or injudicious employment of their waters in other varieties of the disease, not depending on debility; or, what is more probable, the cause of their *desertion* may be that *tyranny* which *fashion* exercises, not less in destroying the well-merited celebrity, than in bestowing meritricious fame on all *watering places*, whether the resorts of the sick or the idle. The continental chalybeates of Spa, Seltzer, Bareges, Swalbach, and Pyrmont, are still highly recommended in these cases.

But it is not in Hyperchondriasis, and one variety of Hysteria, only, that Tonics display a salutary influence in nervous affections; they are equally useful in every case depending on a diminished influence of the nerves on the tissue of organs, especially when this arises from softening of the brain, the cerebellum, medulla oblongata, or the spinal marrow. This state of the nervous centres is displayed on the digestive organs by symptoms of indigestion, weight at the stomach after a meal, and costiveness: on the circulation, by a slow, feeble action of the heart and arterial system, and diminished temperature of the body; on the respiratory organs, by embarrassed breathing; and, on the muscular system, by a repugnance for all exercise which requires a certain expenditure of power; and a strong desire for rest. Tonics reanimate, as it were, by their influence, the vitality of the cerebro-spinal centres, and reestablish their influence over the whole animal system.

In diseased conditions of the muscles of volition, which derive their nerves from the spinal marrow, Tonics are most especially indicated. In *Chorea*, after the administration of purgatives, they have proved the most successful of *all* remedies. Sydenham, Cullen, and the older practitioners, employed only the vegetable Tonics; but the observations of modern physicians have fully demonstrated the superiority of the metallic preparations belonging to this class, in this disease. Amongst these, none equals the Nitrate of Silver. The objection to its employment, namely, the colouring of the skin, is not valid, where the nitrate is guarded with diluted nitric acid. I have administered it for six weeks at a time, without any unpleasant result, but with the most beneficial effects.

The Carbonate or Sesquioxide of Iron has also been successfully employed; and its efficacy more especially ascertained by my late colleague, Dr. Elliotson. Even when the inordinate movements that characterize this disease are attended with headache, vertigo, and symptoms of paralysis, these, as well as the convulsions, have disappeared under its exhibition. The dose of the medicine, as usually prepared, is from ℨss to ℨi, increased

to ℥iii or ℥iv, every six hours: in my mode of administering the carbonate, I have never found it requisite to carry the dose beyond six grains. I have had one opportunity of trying the Iodide of Iron in Chorea, and have found it most efficient: indeed, its utility might have been anticipated: Iodine itself has proved successful in the hands of Dr. Manson, Dr. Gebney, Dr. Peltz, and some others. It must not be overlooked, that when Iodine is overdosed, it is apt to produce shaking palsy, a disease not very dissimilar to Chorea. Its combination with iron prevents this from taking place.

The Oxide and the Sulphate of Zinc, although less frequently employed than the sesquioxide of Iron, are nevertheless medicines of great value in *Chorea*. The former may be given in doses of three grains, gradually increased to ℈i. In the Bristol Infirmary, upwards of forty cases were, with one exception, successfully treated with it by Mr. Bedingfield. In general, it has been given in too small doses; and to this I attribute my own want of success in using it.

The Salts of Copper have also been administered in *Chorea:* the *sulphate*, in doses of one-fourth of a grain, twice a day, carried to that extent which the stomach will bear. Cullen recommended the Ammonio-sulphate.

A case has been recorded in vol. viii of the Edin. Med. and Surg. Journ. by Dr. Uwins, in which *four grains*, in combination with gr. iii of Foxglove and ℨi of Myrrh, proved successful, after every other means had failed.

Both the *Nitrate of Silver* and the arsenical solution have been, also, used with variable success. I have employed the former, after a course of purging, with decided benefit; which I ascribe, in a great measure, to my method of prescribing it, in conjunction with the diluted nitric acid. I usually order the Nitrate in the form of pill, beginning with a quarter of a grain, and washing it down with a draught, consisting of m. x of diluted nitric acid in f℥ii of any distilled water. I have several times carried the dose to *four* or *five* grains. It was found equally efficacious by Dr. Powell, not only in Chorea, but in other convulsive affections.

Among those Tonics which operate directly on the nervous energy, both *cold bathing* and *cold sponging* have been used for the purpose of giving tone and strength to the system in Chorea.

In diseases of the urinary and generative organs, the employment and value of Tonics have been long well known and understood. They are especially indicated in that condition of the uterine organs depending on a general depression of the vital powers, which is attended with torpor, and in which the secreting powers of the organ are either suspended, or reduced below that standard which is required for the health of the

female habit. In this state of the uterus, every part of the system partakes of the general torpor; the circulation becomes languid; the proportion of crassamentum in the blood is defective; the complexion becomes sallow; the digestive process suffers; the tongue is coated with a dirty fur; the breath becomes fœtid; and there are frequent acid eructations. The capillaries of course share in the general debility, and display their deficient action by puffiness of the face after sleep, and swelling of the ankles. The spirits of the patient sink; melancholy and a love of solitude supervene; with dyspnœa, cough, and palpitations; so that the disease has been sometimes mistaken for Phthisis.*

The Tonics most beneficial in this form of *Amenorrhœa*, are the Salts of Iron in combination with Aloëtics or other warm purgatives. Iron in every form has been prescribed; but, upon the whole, we shall find that the combination of carbonate of Iron with soda and myrrh, which is known under the name of Griffith's mixture, has been generally regarded as the most serviceable of the preparations of Iron in such cases. It is in such cases, however, that the Iodide of Iron has been most successful; and I can honestly assure the reader, I have seen no case that has withstood its influence when properly prescribed, and when no organic disease is present. Indeed, the very nature of the compound adapts it admirably to fulfil the double indication in this affection; by affording general tone at the same time that the uterus, as a part of the secerning system, is acted upon by the iodine. The Iodide is best administered in solution, which should be perfectly neutral. As pure air and exercise are very important in this condition of the system, when the patient has a little advanced towards recovery, much advantage is derived from resorting to Tunbridge, or some other chalybeate spring. The power of the iron, in its natural state of a bicarbonate, is greatly aided by change of scene, a more salubrious atmosphere, and amusement to the mind.

In *Scrofula*, a disease of the lymphatic system, Tonics are the chief resources. It is unnecessary here to attempt even the slightest sketch of the nature of this multiform disease: it manifests itself by more or less unequivocal signs in every organ of the body; in the solids and fluids; in the soft tissues, the muscles, the blood vessels, the glands, and the bones. Under all its forms, Tonics are indicated; even when inflammation, requiring depletory measures, exists, as its coexistence with the scrofulous diathesis renders it indolent in its character; more especially when it is attended with little constitutional disturbance, and is confined to some organ or other, as, for instance, the conjunctiva, in which the efficacy of bark and the salts of Quina has been well ascertained, and long acknowledged. The salts of Quina are certainly the most active of the vegetable

Tonics in *Scrofula*, from the concentrated form in which they can be used, and are the most generally available: but their action must be watched, and their use intermitted on the first appearance of any degree of feverishness.

Of the metallic salts, those of Iron have been found most salutary. The usual forms of administering Iron is the Tincture of the hydrochlorate and the sesquicarbonate; the chalybeate mineral waters; and, more recently, the Iodide; which, as I have already stated, combines the advantages of Iodine, which has been most successful as a stimulant in its uncombined state, and also those of the Salts of Iron. I have found that the best form of prescribing the Iodide, in every variety of Scrofula, is in the form of syrup, in combination with the Iodide of Potassium. This combination is peculiarly indicated in those cases of a chronic character which are accompanied with feeble action of the stomach and the assimilative organs, and which require the aid of both stimulating and tonic remedies. The Iodide, in this form, has one advantage over simple Iodine; it does not accumulate in the system, nor, when taken in excess, does it produce that inflammatory condition of the mucous membrane, nor diarrhœa, nor the irritative fever, which often follow the use of simple Iodine.

It only remains to examine the influence of Tonics in febrile affections. Tonics operate in two ways, in this class of diseases. 1. As simple corroborants or supporters of the strength. 2. As antiperiodics, or destroyers of that catenation of diseased phenomena which constitute the paroxysm of intermittents.

It is only in low fevers, and in the latter stages of simple fever, when the vital powers flag, that they are indicated to fulfil the first intention. The febrifuge powers of the Cinchona barks have been at one time extolled too highly; at another, most absurdly underrated: indeed, no article of the Materia Medica has sustained a more varied reputation; and, at the present, the question is still undecided. Much has been said about the period of the disease at which it can be safely and efficiently administered. Dr. Clarke, of Newcastle, gave it at every period, and cured the disease; and Dr. Heberden, in referring to this question in his Commentaries, remarks—"Unde didicimus suspicionem, periculi a cortice etiam sub ipsa febre adhibito, fuisse non minus vanam, quam multas alias suspiciones, quas nostri majores de utilissimo hoc remedio sparserunt."—Cullen, however, taught that, whenever blood-letting is proper in continued fever, bark is always injurious; an opinion which has decended to the present time, and was in particular strongly supported by the late Dr. Bateman. If my opinion of the distinction between *Stimulants* and *Tonics* be admitted, the fallacy of the reasoning of Cullen, and those who have followed him, must be evident. I would not go so far as to prescribe bark,

or Sulphate of Quina in the early stages of epidemic fever; but, even when evacuants and contrastimulants, such, for example, as Tartar Emetic and Calomel, are called for; if the tone and strength of the system require support, I would not hesitate to resort to Bark, or any other Tonic which possesses little *excitant* property, to call forth the power of action of the arterial system. It is the confusion between *excitement* and *tone* which has brought forward most of the objections to the use of Tonics in fever; and, on enquiry, we shall find that most of those who have regarded them injurious, have not hesitated to combine them with wine and other stimulants; and have not made that strict search for *local inflammation*, which certainly, in many instances, may interfere with the administration of Tonics. It is, in my opinion, absurd to speak of the stimulant power of Bark increasing febrile action, when the nervous system is depressed, and there are no local complications to forbid its use. No mischief can accrue from supporting the nervous system in good order by Tonics, if we avoid the causing overaction by *excitants*, when fever exists. Excitants increase action; but *action* is not *strength;* and it is in bestowing this, that pure Tonics prove serviceable in fever. When, in the latter stages of typhus, the failure of the powers of life are denoted by petechia, and a tendency to gangrene, then the addition of wine and other diffusible stimulants to Bark is not only allowable, but necessary; and it is under these circumstances that we find *Cascarilla*, *Cusparia*, and those vegetable Tonics that contain an aromatic principle or a volatile oil, the most useful adjunct to Bark and the Salts of Quina. In low fevers, however, the Bark or the Salts of Quina, and the Tonic vegetable infusions, should not be administered until the habit has been fairly brought under the influence of Calomel; when the tongue is cleaning; and the heat of the scalp is greatly reduced.

In *Rheumatic Fever* they are equally beneficial, after the action of Calomel and Antimonials.

2. With regard to the Antiperiodic power of Tonics, this is not peculiar to all Tonics, nor is it alone attributable to this class of remedial agents. Before the introduction of the Disulphate of Quina, Cinchona Bark was the most powerful of the Antiperiodics; but its use has been wholly superseded by the Disulphate of Quina. It is not easy to explain satisfactorily the manner in which Antiperiodics operate. In the paroxysm of ague, the first stage is that of coldness and bloodlessness of the skin and the extremities: the second, a violent determination of blood to the parts previously chilled; excessive heat, redness, and fulness succeed: and the third, a copious evacuation of sweat. Now, experience has proved, that whatever can prevent the occurrence of the first stage, checks the other two, which are necessary sequences. If the paroxysm be left to itself, the

most conspicuous circumstance is the shivering; on the violence of which, and, within certain limits, on its duration, the degree of the hot fit depends. Dr. Parry imagines that the shivering, which consists in short, quick, and frequently repeated convulsions of various muscles, which tend to accelerate the circulation of the blood and stimulate the heart to increased action, is a salutary process, or a modification of exercise intended to restore circulation and heat to the parts, in which both were before defective. This idea receives some support from the fact, that if a person, on the first approach of the paroxysm, have the resolution to run violently, he will check the shivering, bring on a very mild hot stage, and, in truth, in a great measure, prevent altogether the paroxysm. Whatever tends, therefore, to prevent the cold stage, breaks altogether the catenation of morbid phenomena that constitute the paroxysm; and it is in this manner that Antiperiodics operate. In doing so, however, it can only be the tonic influence of these remedies, supporting the constitution and preventing the nervous atony, which is the immediate cause of the coldness of the surface and the accumulation of the blood in the vascular trunks, that enables them to act as Antiperiodics. It has been, however, supposed that the power of these remedies over Intermittents is *not* in the ratio of their *tonic* power. Now, I confess that I cannot understand this mode of reasoning. I know of no Antiperiodic which is not a Tonic. It is not easy to appreciate the degrees of their tonic powers, compared with one another; but it is undoubted, that Peruvian Bark, and the Disulphate of Quina, are the best Antiperiodics of the vegetable Tonics, and also possess the greatest share of tonic power. The fact that Arsenious Acid, and its compounds with alkalies, are perhaps more powerful Antiperiodics, depends very much on circumstances, which have not been taken into account in estimating the comparative value of Antiperiodics. Thus, we find that the Bark and Disulphate of Quina are the grand Antiperiodics in the Intermittents in India during the cold season; yet, that they fail altogether in the rainy, in which Calomel and Antimony prove useful. But, because this is the fact, no person will contend that the Calomel and Antimony are superior Antiperiodics to Bark and Disulphate of Quina. Even when Intermittents are cured by charms, to what can we ascribe the benefit derived from the influence of these on the minds of the superstitious, if it be not to Confidence operating as a Tonic, and supporting the system against the depressing agency to which the cold stage of the paroxysm is due.

The cause of the intermittence, or the periodical return of the paroxysm, has been attempted to be traced by distinguished pathologists; but no satisfactory explanation has yet been afforded; and, therefore, I will not detail opinions which cannot

be received. It is sufficient, in a practical point of view, to know that Antiperiodics of every kind act with most energy when administered during the *apyrexia*, or interval between the paroxysms. At this time, gr. ii or gr. iii of the Disulphate of Quina may be given every hour, or every second or third hour in quotidians; or from gr. iv to gr. v every sixth hour, in tertians and quartans. Larger doses are often given, and circumstances may justify them, especially when the cases are of a complicated or malignant nature: but, in general, I prefer the smaller doses, repeated at short intervals. On account of the little solubility of the Disulphate of Quina, it is administered in combination, or at the same time, with diluted sulphuric acid. I have found that the neutral Sulphate, previously formed, is a much more manageable form of prescribing the remedy; and it does not require any additional quantity of acid.

Soon after Bark was introduced for the cure of Intermittents, controversies arose, whether the influence which it evidently possessed of cutting short an ague, was really desirable; and whether some of the evils, that are sequela of that disease, were not the consequence of suddenly checking the paroxysm? The fallacy of the idea, that the enlargements of the spleen, and other evils, result from the employment of Bark and its salts, has been most satisfactorily proved; but, at the same time, these remedies ought not to be administered under all circumstances. Thus, experience has proved, that when they are employed in imperfect Intermittents, coexistent with local inflammation, we hazard the conversion of the disease into a *remittent* or a *continued* fever. It is therefore always necessary to endeavour, by Calomel, topical bleeding, and other means, to produce an interval of complete apyrexia before prescribing Bark or the Salts of Quina as Antiperiodics. In making this remark, it may not be out of place here to say, that although these remedies would be hurtful during the continuance of recent topical inflammation, yet that chronic engorgements of the spleen and other abdominal viscera do not preclude their employment. In some cases, also, whilst depleting measures are pursued to subdue inflammation, and at the same time it is of importance to check the periodic recurrence of fever, although Bark or Disulphate of Quina cannot be properly administered, yet some other antiperiodic may be employed.

The *Arsenical Solution* is an antiperiodic of great power; and may, at any time, supply the place of Bark or its preparations: and as it is often necessary to change the antiperiodic employed, as the system becomes habituated to its use; next to Disulphate of Quina, the arsenical solution is certainly the most potent. When judiciously administered, no bad consequences follow its continued employment; but if nausea, griping, or other uneasy feelings attack the digestive organs, the dose

should either be immediately lowered, or the use of the remedy be altogether suspended. The usual dose at first is from eight to twelve minims; but it may be very gradually increased to that extent which the stomach will readily bear. I have, more than once, carried it to seventy minims, three times a day.

Sulphate of Zinc, in doses of three grains, in combination with aromatics, and given three times a day during the intervals, also operates as an antiperiodic. *Piperina* and Chamomile flowers, which owe to it much of its activity; *Salicina*, the active principle of the Willow bark; *Caffein*, that of Coffee; Quassia, and other bitter Vegetable products, are also antiperiodics; and some of them, especially the resinoids, are said to possess powers equal to that of the salts of Quina in Intermittents.

Intermittents of a malignant character, when complicated with affections of the brain or its membranes, or with abdominal or thoracic affections, do not admit of the administration of antiperiodics, until after the local affections are subdued by the lancet and purging. If the case admits of delay, then it is preferable to postpone the use of antiperiodics: but if it do not, we may employ them; and at the same time administer antiphlogistics: but, in selecting our remedies, we ought to choose those Tonics possessing little or no stimulant property. In every form of disease, when intermittence occurs, benefit may be derived from antiperiodics.

I have placed *Cold* as a Tonic agent operating directly on the nervous energy; for although, when it is long applied to the habit, and in an intense degree, it operates as a sedative, yet, in the form of the Cold bath, the sudden depression of the nervous energy is succeeded by reaction, the effect of which is to throw the blood upon the surface, and to produce a more energetic action of the arterial system than existed before the immersion in the bath. In the first instance, the cold being suddenly applied to the surface, the immediate effect on the sensation is communicated to the whole of the nervous system, which seems as if about to yield beneath some hurtful agency; but, before time is permitted for any important function to be materially disturbed, the conservative energies of the system are roused to resistance; and this succeeds in producing reaction, when the vigour of the system has not been previously oppressed. When caloric is suddenly abstracted from the body, by its immersion in the cold bath, the action of the superficial vessels is lessened, and a lower degree of caloric produces much greater excitement than previously existed; hence the glow felt on the return of the blood to the surface. The centres of vital energy, the brain and the heart, are roused; and the heart acts with greater force on its contents: the transmission of the blood through the capillaries is restored; heat and renovated action

ensue; and these continue until the excitability regains its natural equilibrium. By the reaction which takes place after cold bathing, tone is propagated over the whole system; but it is not, however, the abstraction of the heat from the surface which produces this reaction: it is the sudden application of the cold medium to a large extent of surface. When the nervous impression, or shock, is the chief object in using the bath, the temperature of the water should be low, and the immersion sudden and brief. The shower bath, perhaps, is the best mode of producing this effect, and securing the reaction, which is essential when a permanent tonic result is expected. The reaction is always in the ratio of the coldness of the water, and the height from which it falls. As something also depends on the vigour of the constitution; when the bather is weak, the system should be fortified by a glass of wine, or some warm beverage, before using the bath. If, instead of a shower bath, a plunging bath be used, inasmuch as muscular motion favours reaction, the bather should move about in the bath; or swim, if he can, and the nature of the bath admits of that exercise; and, on coming out of the bath, he should be rapidly dried, and active bodily exercise or friction resorted to.

As part of the tone caused by cold bathing is induced by the nature of the medium and the density of the fluid, *sea-bathing* is a preferable Tonic to fresh-water bathing; and the beneficial result is still farther aided by the stimulant influence of the saline particles left upon the skin. The equable temperature of the sea would render it available at all seasons, were it not for the cold of the atmosphere to which the body must be necessarily exposed. During the immersion in the sea, there is apparently less abstraction of caloric from the body than during immersion in fresh water, and the reaction which follows continues longer. Dr. Currie immersed two individuals for the same length of time, namely, thirty-five minutes, in salt and in fresh water at a very low temperature; little inconvenience was felt by the individual who used the salt bath; whilst he who used the fresh could not be restored without the aid of friction, continued for a very considerable time. Seamen seldom catch cold or get rheumatism at sea in dry weather, although the body be frequently bathed with spray; but they are liable to rheumatism in rainy weather. Captain Bligh, who traversed an immense tract of ocean, with seventeen seamen, in an open boat, preserved himself and his companions from disease by immersing their shirts and jackets in sea water, and obliging them to be worn in their wet state.

Besides the influence of the saline particles in sea water, much of the beneficial effect of sea-bathing depends on the condition of the habit of the patient at the moment of immersion;

and the degree of exercise previously taken. This should never be carried to fatigue, nor be enough to induce profuse perspiration. This precaution, however, is less necessary in healthy persons of vigorous habits, who bathe for pleasure. The Roman youth, covered with dust and perspiration, hot from the violent exercises of the Campus Martius, plunged into the Tiber with impunity.

There is no absorption of the salt water, as has been supposed: the effect on the surface is propagated to the whole system by nervous sympathy. On this account, the moisture, which adheres to the skin in sea bathing, should not be wiped off when the bather comes out of the water; and when sponging with salt water is used as a Tonic, the moisture should only be soaked up with a soft towel, so as to leave the saline particles on the skin: and as the susceptibility to the impression of cold is lost, the moisture should be permitted to evaporate, so as to leave a crust of saline matter behind it on the cuticle. Little benefit can be expected from sea-bathing, unless it be continued for at least a month or six weeks.

Fresh water cold bathing is also tonic, according to the degree of temperature at which it is employed. The degree of cold may be too intense to be followed by tone; hence there is danger in bathing in fresh-water springs: it is followed by the same injurious results as too long an immersion in any cold medium. If, instead of reaction, and a glow of warmth over the surface, chilliness remains, with drowsiness, and general languor; cold bathing, whether in salt or fresh water, should not be employed, or the system should be fortified with a hearty breakfast, or with wine, or by exercise moderately taken, before using the bath.

It has been supposed that, as the nutritive function is more active in young animals than in old, and the circulation more rapid, the temperature must be higher, and, therefore, the precautions necessary in using the cold bath are less essential for children than for adults: but the experiments of Dr. Edwards have proved this to be a mistake. I have seen, also, much mischief produced by boys of weak constitutions, or of strumous habits, remaining long at a time in the sea, whilst bathing with adults who did not suffer.

The diseased conditions of the body, for which cold bathing is indicated, are debility and a weakened state of the digestive organs: in nervous diseases, and in the condition of listlessness and indolence of the mind, when no organic affection is present. This state of habit often follows severe acute diseases; and is a frequent attendant on sedentary occupations: but the cold bath requires to be used with caution when the powers of the body are too languid to produce reaction. This reaction is the great

object of cold bathing, and should be obtained at as little expense of the animal heat as possible. When the person is very weak, the tepid bath should precede, for a short time, the use of the cold bath; and much care should be taken to ascertain whether there is any internal local disease of consequence, as in that case even cold sea-bathing will prove hurtful. Whether sea or fresh water be employed, if the patient feel the shock of the immersion very severely; when no glow succeeds it; and other symptoms demonstrate that the reaction is not sufficient; then the cold bath is always productive of harm.

In chronic diseases, the cold bath is an admirable Tonic: it raises the animal temperature, which is always too low in these cases; and, consequently, it invigorates the moving powers, excites the nervous energy, and imparts activity to the whole frame. Cold bathing, in these cases, is preferable to exercise, which merely establishes the perspiratory secretion; whereas cold bathing excites the whole circulating and nervous systems, producing not only a more universal, but a more permanent result.

In no diseased state of the habit is the tonic influence of cold bathing more strikingly displayed than in that feverish condition which frequently attends studious men, whose habits are necessarily sedentary. In such persons, the pulse is generally quick; the hands are hot; the bowels are irregular; the appetite is impaired; and their nights are restless; symptoms which prepare the way for the approach of the worst of all diseases, not of a mortal kind, namely, confirmed hypochondriasis. Such individuals bear cold bathing well; and when, at the same time, study is relaxed and the mind amused, the disease readily yields to its powers. On the contrary, irritable gastric dyspepsia, another disease of the sedentary and anxious, is not benefited by cold bathing. This has been attempted to be explained by supposing that, owing to the sympathy which exists between the stomach and the skin, every excessive impression on the latter must necessarily cause some disturbance on the former: and, as the process of digestion requires a uniform state of animal temperature, this cannot be interrupted, when the stomach is weak, with impunity.

In *Chlorosis*, in young females, attended with suspension of the menstrual discharge, cold bathing, as a Tonic, is injurious. Even the shower bath, which usually is borne well by young patients, is to be employed with caution; for, as no reaction can be induced, owing to the habitual defective action of the surface, the low temperature is likely to cause internal congestions, and favours apoplexy. It is in such cases most especially that the preparations of Iron and other Tonics are indicated.

In cases of symptomatic debility, the result of some local affections, cold bathing, like all other Tonics, is injurious at every period of life. Instead of being strengthened, such persons are weakened by cold bathing, and great risk is incurred, not only of increasing the primary disease, but of producing others. Permanent headaches have sometimes been caused by such practice. On the contrary, when the debility is general; when the skin is flabby, and there is a tendency to warm perspiration on slight exertion, sea-bathing is particularly indicated. It is requisite to ascertain that the depressed condition of the system is not the prelude to the development of tubercular disease in the lungs, *tubercular Cachexy*: and it is essential to know that tubercles are not already in an active state in the lungs; as, in both cases, cold bathing will be found to disagree, and accelerate the pulmonary affection.

In nervous diseases, such as *Chorea*, *Hysteria*, *Epilepsy*, *Aphonia*, *loss of smell and taste*, *local paralysis*, and cases of *old palsy*, cold bathing will prove a useful Tonic, provided no organic disease be present, either in the brain or the spinal marrow. If any doubt exist as to the real condition of these organs, the shower bath may be tried; and, in every case of convulsions, this is the only mode of using cold bathing which is safe.

In *leucorrhœa*, *gonorrhœa*, *old dry catarrh*, and that which depends on a relaxed state of the mucous membrane: in *passive* hæmorrhages, particularly *epistaxis* and *menorrhagia;* and in *amenorrhœa*, when there exists neither plethora nor chlorotic debility, cold bathing, under due restrictions, operates as a beneficial Tonic. In no disease is it more useful than in the intervals of the paroxysms of Asthma, and of Tertian Agues. It gives tone to the nervous system, and renders it less susceptible of morbid impressions.

Cold Bathing, as a Tonic, is said to be inadmissible during the menstrual period; but much depends on habit. The women who attend female bathers at Brighton and other sea-bathing places, do not intermit their occupation at that time, and suffer no inconvenience from doing so. Caution, however, is requisite in others; and, also, during pregnancy. It is inadmissible for those affected with diseases of the heart, particularly with dilatation, in which other Tonics prove useful; or with valvular obstruction, from the large quantity of blood suddenly thrown upon the diseased organ. It is also improper in loaded states of the bowels, with engorgement of the venous system of the abdominal viscera; and in those affections of the skin which are apt, when suddenly repelled, to be followed by internal diseases.

Such are the Therapeutical uses of Tonics; a class of me-

dicines which has been more misapplied than any other; and which, consequently, has been productive of much evil: but which, nevertheless, in the hands of the well-educated, observing, and judicious practitioner, is one of great importance in the treatment of disease, whether in combating periodical affections, in supporting the habit under the depression of actual disease; or, in convalescence, carrying it on to a state of sound and permanent health.

SECTION XI.

ASTRINGENTS.—MEDICAMENTIA ASTRINGENTIA*

Astringents are substances which produce contraction and condensation of the muscular tissue. To understand this definition, we must know what is meant by muscular tissue and its properties. As far as the unaided power of the eye can guide us, the muscular tissue appears to consist of bundles of fibres, which are flattish, linear, soft, white in some animals, red in others, and plaited in their length. But, when the microscope is called in to aid our limited vision, we find that the fibres, of which these bundles are composed, are themselves either beaded, or they are bundles of small cylindrical fibres, enclosed in thin membranous expansions, and held together by a tenacious fluid. If we examine the opinions regarding the nature of these fibres in the writings of microscopic observers, we find the most opposite descriptions of them. Muys and Lewenhoeck maintained that each fibre is composed of still smaller fibrils, in the proportion, said Muys, of 900 in the thickness of the finest hair; but, according to Lewenhoeck, of 3180; as he assures us that he counted that number in the muscular fibre of a fish. On the contrary, Prochaska avers, in the most positive manner, that the size of the ultimate fibril is about the 50th part only of the diameter of the red globules of the blood. Later investigations even extend this magnitude: the observations of Professor Schultze make the ultimate fibrils to be uniform filaments; but those of Sir E. Home, Mr. Bauer, Milne Edwards, Prevost, Dumas, and Krause, regard them as a series of globules, exactly corresponding in size with the uncoloured globules of the blood, connected by an elastic medium,

* Derived from *astringere*, to contract.

by means of which a visible interval may be produced between the globules; but this globular structure is denied by Dr. Hodgkins, who regards the ultimate filament as truly fibrous. Dr. Hare affirms that each fibre consists of minute tubes, $\frac{1}{180}$th part of an inch in diameter, and exhibiting longitudinal striæ with transverse bands. Mascagni describes it to be a cylinder filled with glutinous matter; whilst Meckel and Rudolphi believe that it is solid. It would be out of place here to criticise these descriptions of the ultimate muscular filament: the knowledge conveys no real information, and, in the language of Bichat, "is merely a concourse of vague ideas." Whatever may be the form and magnitude of this part of our structure, it is of more importance to know that it is connected with cellular tissue, exhalant and absorbent vessels, arteries and veins, as well as nerves, both of sensation and of motion.

The distribution of nerves to muscles is unequal, and the power of contraction appears to be nearly in the ratio of the number of nerves with which a muscle is supplied. The nervous trunks, in entering a muscle, run in the direction of the muscular fasciculi, giving out laterally twigs which divide and subdivide in the interstices, until they can no longer be traced, and appears as if absorbed or lost in the tissue of the fibrils. It was at one time believed that the nervous filaments deliquesce into an invisible pulp, and unite intimately with muscular fibrils; but the later observations of MM. Prevost and Dumas have demonstrated the error of this opinion. According to these physiologists, the minute filaments of a nervous cord, entering a muscle, traverse its fibres, which they consider to be composed of short lines, disposed in a series which can be approximated to each other. The nerves traverse these at a right angle, and at short distances from one another, and then either return to the same nerve, or anastomose with some neighbouring branch of another. This fact applies directly to our enquiry. In some instances, as in the muscles of the face, there is a junction of nerves of sensation with nerves of motion: yet this union does appear to exist in all muscles. With regard to blood-vessels, no organs, in proportion to the extent of their volume or bulk, are so amply supplied with blood as muscles. The arteries, given off from the neighbouring large trunks, penetrate the substance of the muscle, then divide to supply the secondary bundles of fibres, and again and again subdivide until they become capillaries attached to the fibrils. Such is the muscular tissue: therefore, under whatever form it appears, it is a compound substance; it possesses also compound functions, or, in other words, both physical and vital properties.

A muscle owes its physical properties, its cohesion, flexibility, and extensibility, to the same causes as matter in general: its elasticity is also a physical property; but its contractility, or

the power of shortening itself, is solely a vital property. In this contraction there is a real generation of power: it is distinct from any other power in nature, is peculiar to life, and is regulated by laws different from those of any other action: it does not cease immediately on the extinction of life, and indeed continues, in some degree, until putrefaction takes place. But, although it be admitted that the contractility is inherent in the muscular fibre, it must, also, be admitted that we know of no means by which this power can be excited without the intervention of nerves. If the muscle on the belly of a frog be so placed in a frame that the galvanic fluid may be directed through it, the following phenomena become apparent under the microscope. When the stimulus is applied, the fibres shorten themselves, or rather the two extremities of the fibres are seen to approach one another, by the intermediate space bending at numerous angles into zig-zag lines; but when the stimulus is withdrawn, the fibres regain their straight direction. Prevost and Dumas, who made this observation, in confirmation of what had been previously observed by Dr. Hales, assert that these angles are nearly at equal distances, and correspond with the intersection of the nervous filaments. The accuracy of this observation has been doubted by Prof. Owen, who examined the contraction in small filaria, and found that the fibres, during contraction, did not fall out of the straight line*. But, without entering into this question, it may be asked, is that condition of the muscular fibre which causes contraction, peculiar to it only when that power which may justly be denominated muscular is exerted? is the same fibre, whatever may be its condition as to tone, a straight fibre, when this power is dormant? To reply to this question satisfactorily, would require more powerful microscopes, and a greater perfection in using them than has been yet ascertained: I will therefore assume it as a fact, that, whatever may be the linear direction of the ultimate muscular fibrils in their state of tone, or greatest density and cohesion, this state is intimately connected with and solely dependent on vitality. This is demonstrated by the fact, that a muscle, which during life can sustain a certain weight, is torn asunder by the same weight after death, or after it has been for a short time separated from the living body: the great tonicity of strength of muscles during life depends, therefore, on a cause different from that of simple cohesion, and exists only during the life of the part. But this state is not always the same during life. In certain conditions of the habit, the muscular fibres seem to lose, in a great degree, their cohesiveness and elasticity; and with these, their contractility, or property of responding to the will and of contracting on the application of material excitants, is

* Hunter's Works, edited by R. Owen, F.R.S. vol. iv.

lessened; and the hollow muscles, in particular those surrounding the arteries, lose their power of resisting the pressure of the contained fluids, which either burst their coats or find their way through them, producing what is termed passive hæmorrhage. This loss of contractile power is also perceived in the abdominal muscles of women who have borne many children, and in the scrotum after the discharge of the fluid from an old hydrocele. Astringents are indicated to remove this condition of the muscular tissue; and, keeping in view the nature of the parts on which their influence is exerted, let us examine in what manner their action is to be explained.

Most of the writers on Materia Medica have endeavoured to explain the influence of Astringents on the living body, by reasoning analogically from their influence in hardening and condensing dead animal matter. It is true that the substances which bestow toughness, solidity, and impermeability, to the soft skin of a dead animal, so as to convert it into leather, operate as Astringents on the living muscular fibre. Looking at this fact, were the enquiry to proceed no further, it is not surprising that erroneous inferences should be deduced from it in explaining the action of Astringents: indeed, the presence of life seems in some instances rather to favour than to resist the chemical operation of Astringents. But still the appearance of similar results, in conditions of the body so opposite as that of life and death, is not conclusive that the cause is the same in both cases. In examining the question, let us first trace the causes of the effects which Astringents produce on dead animal matter; then examine whether the same circumstances occur in the living body, and endeavour to frame some satisfactory theory of the operation of Astringents on the living solid.

The material agents which produce on dead animal matter that change of condition which is supposed to be the result of astringency, are *cold*, *alcohol*, *tannic acid*, and other *acids*.

Cold, the first of these agents, is a negative quality, the absence of a positive agent, *caloric*. When caloric passes from a body containing much of it, into another which contains less, until both arrive at an equilibrium, the bulk of the former is lessened, that of the latter is increased; and the consequence, therefore, of the accumulation of caloric in any body is the separation of its particles and a consequent reduction of the cohesion of that body. Now, if the presence of caloric weakens this force, the abstraction of it must necessarily increase it; the body is condensed, it occupies smaller space, and proves more capable of resisting any force applied to separate its parts than when the caloric is present in it; or, in other words, the strength of the body is augmented by the abstraction of any unusual quantity of caloric. A thong of an untanned skin, which can support a weight of ten pounds in a temperature of 85°, will

support an additional weight at a temperature of 40°. With respect to the living body, it is an undoubted fact that cold operates as an Astringent to the animal solid. In warm weather, in the same climates, the muscles of the living animal are softer, less capable of powerful action, and more feeble in every respect, than in cold weather; nevertheless, caloric is a stimulant to the living body; and as such it ought to augment the strength of the muscles. To explain and reconcile these contrary facts, we must keep in view that law of the system by which the continued action of every stimulant is followed by collapse: that, when this occurs, the vitality of the part is so much lowered, that the ordinary physical laws connected with the operation of caloric exert their influence on the body; and, consequently, the debility of a muscle in warm weather is due to the same cause which weakens the cohesive power of dead animal matter. Abstract caloric, therefore, from a living body, the first effect is of a physical kind; the parts of the living muscle are mechanically condensed: but it is the exertion of the living principle on the restored excitability of the part which renders the condensation permanent and maintains its tonic power. Hence we may conclude that, as far as *cold* operates as an Astringent, we cannot explain its operation as such by reference merely to its effects upon dead animal matter.

With regard to the action of the second-mentioned agent, *Alcohol*—if a piece of muscle of a dead animal be put into it, the bulk of the muscle is lessened; at the same time, the muscle itself is hardened; and this is generally referred to the astringent property of the spirit; but chemistry informs us that alcohol has a strong affinity for water; that, in attracting it from the animal matter, the albumen is coagulated; and that, this contracting, the other solid components are more closely compacted with it, and the whole mass becomes smaller than it was before it was put into the alcohol. Now, when alcohol is applied to the surface of the living body, it operates as an excitant; but no coagulation of albumen results: if the quantity be great, and its strength considerable, an immediate cessation of motion takes place in the capillaries; the globules of blood stagnate, as it were, and become compacted in the dilated vessels; the vitality of the part is either suspended or destroyed—a fact which is rendered obvious in the web of the foot of a frog examined under a powerful microscope. But if, on the other hand, inflammation previously exist in the vessels of the part, the application of diluted alcohol stimulates the coats of the inflamed vessels, contracts their diameters, by constringing their circular fibres, and thus relieves the previously overloaded vessels. In this case, we can derive no aid in explaining the cause of the astringency of alcohol applied to the living body by reference to its effects on dead animal matter.

Nearly the same reasoning is applicable to the action of *Acids*, which act as Astringents, whether externally applied or taken into the stomach. These acids corrugate the dead animal fibre; and act chemically upon it, coagulating the albumen, and forming new compounds: on the living fibre they operate as excitants and tonics, increasing the general vigour of the frame, and producing that state which is termed tone, in which the adhesive power of the particles is augmented without any change in their composition. Here, again, are two states of bodies as opposite as possible, produced by the action of the same substances; but certainly from very different impressions.

The most important of these acids is the *tannic*. Plants which contain it, when taken into the mouth, seem to draw the parts together; and by the extent of this sensation we judge of the degree of astringency of the plant. When applied to dead animal matter, they apparently act by shortening the longitudinal length of muscular fibres, and diminishing the diameter of vessels: but, besides these effects, we find that a new substance is formed which did not previously exist: the tannic acid unites chemically with the gelatin of the dead animal matter, and forms a solid, insoluble compound, which resists the action of water and does not putrefy. Something of the same kind is produced by the application of tannic acid to the living body: thus, if Catechu and other powerful Astringents, which contain much of this acid, be mixed with newly drawn blood, whilst it is yet flowing from the vein of an animal, the blood is coagulated sooner and more firmly than when no astringent matter is mixed with it; and, when the aqueous solution of Catechu is injected into the veins of living dogs, the animals are killed, and the blood in the heart and large vessels is found firmly coagulated. We nevertheless cannot admit that vegetable Astringents operate in the same manner on living as on dead animal fibre, obviating mechanical laxity by their coagulating power; for, unless debility be a mere mechanical defect of cohesion of the muscular fibres, this condition cannot be removed by the coagulating power of the astringents, as in dead animal matter. To use the language of Dr. John Murray, " it is now admitted that every degree of strength or weakness depends much more on correspondent variations in the state of the powers peculiar to living matter; and substances capable of obviating disease dependent on any state of debility, must be such as are capable of acting upon these powers. Many substances accordingly, arranged as Astringents, occasion very considerable alterations in some of the functions: they produce effects which cannot be referred to their condensing power, allowing them to possess it; and, therefore, in all the changes they produce, part of their operation, at least, must be referred to actions which they exert, conformable

to the laws of the living system*." Upon the whole, we have no hesitation in concluding, that no satisfactory explanation of the action of Astringents in the living body can be founded on the analogy of their action on dead animal matter. Indeed, it may be affirmed, not only of Astringents, but of all medicines, that their operation does not depend on ordinary physical laws—those "of matter and motion," as Dr. Cullen remarks, "which take place in inanimate bodies—but on a principle which subsists in living bodies only†." Hence we refer the action of Astringents to the laws of the living system; and it is evident that they operate chiefly as excitants: but, in stating this opinion, it is requisite to draw the distinction between Astringents, Excitants properly so called, and Tonics.

Excitants act powerfully on the excitability and sensibility of the part to which they are applied, causing sensation and a sudden contraction of motion; and extending their action over the whole habit: but this is followed by relaxation. *Astringents* operate, also, by causing sudden contraction: which is unattended by sensation, and is evidently different, both in degree and in kind, from that caused by excitants. *Tonics*, whilst they promote contraction and density, operate slowly, and their influence is confined within that limit which may be regarded as the natural state of the healthy solid. Thus, the distinction between the three powers—stimulus, tone, and astringency, is sufficiently obvious. If an Astringent be applied to any part of the body on which the action induced admits of ocular demonstration—as, for example, the lips—the first effect produced is a contraction of the muscular fibres and the blood-vessels of the part; the lips become pale, a sensation of dryness and roughness is felt on the palate, the effect of a real corrugation, owing to the action of the Astringent on the motor nerves of the parts exciting the contractility of the muscular fibres. But this action differs from that of an ordinary excitant, which rather rouses the sensibility than causes the contractility of the muscular fibre; whereas the Astringent acts on the contractility only, and a corrugation or new arrangement of the component fibrils—shortening, thickening, and condensation—are the consequences. We are conscious of these effects when they occur in a sensible part; but the sensations appear to arise rather from the compression of the extremities of the sensitive nerves, by the condensation of the contracted fibres, than from any immediate impression of the astringent substance on the sensitive nerves. The sensation therefore induced is a secondary effect; arising from the immediate impression of the Astringent on the minute extremities of the motor nerves.

* System of Materia Medica and Pharmacy, by J. Murray, F.R.S E., 1813, vol. i, p. 268.

† Cullen, Lectures on Mat. Med.

In regarding Astringents as excitants, we should understand the distinction between their operation and that of excitants that affect, decidedly, the sensibility. When a general excitant is applied to a sensitive part of the body, the impression is made on a set of nerves which serve merely as media of communication between the brain and the parts affected; the mind, therefore, becomes conscious of the impression; and the motion which follows is the result of that affection of the mind which we term volition, operating on the origin of the nerves of motion, supplying the impressed or stimulated part. It may be contended that contractions occur in muscular parts from the application of excitants independent of volition; for a sharp instrument run into any muscular part will produce an immediate contraction. I admit the fact; and I must also admit that, when contraction occurs in a muscle separated from the body, the effect cannot be regarded as the result of volition: but I contend that, in every instance accompanied with sensation, volition is more or less the power which calls the muscle into action. When an Astringent, however, acts upon a part, no communication of this kind takes place, the nerves of motion are *immediately impressed*, and a movement in the fibres only which they supply occurs.

If this view of the subject be correct, we may venture to explain the operation of Astringents by saying, that they *stimulate directly the ultimate fibrils of the motor nerves*, and, through them, produce an immediate effect upon the insensible contractility of the fibres which these nerves supply. It is not difficult to conceive that such an action, excited in a part, may be propagated by sympathy to other parts, or even to the whole system: hence, if any acerb fruit be chewed, along with the corrugation felt in the mouth, a peculiar feeling extends over the whole body. This extension of the action of Astringents may, in some degree, explain the benefit resulting from their employment in checking the inordinate secretions of distant organs: but it is more probable that they are taken into the circulation; for, without such a supposition, we should not be able to explain the manner in which they act in stopping hæmorrhage when internally administered, especially when taken into the stomach. Sir B. Brodie gave to a patient, who had a frightful hæmorrhage from the prostate gland, and in whom all other remedies had failed, a large dose of *Ruspini's Styptic*, and repeated the dose twice in the course of twelve hours. About half an hour after the first dose was taken, the bleeding ceased, and it never recurred. I have ascertained that the astringent principle of this Styptic is Tannic Acid.

From these premises, I venture to offer the following theory on the nature of Astringency. I conceive it to be a power which, through the medium of the motor nerves, acts on the

insensible contractility of the muscular fibril, producing a closer approximation of their component particles; and, by thus augmenting their cohesion, causing a greater and more permanent density, and a corresponding vigour in the muscular tissue. This action differs from ordinary muscular contraction, in not being dependent on the nerves of sensation, and consequently in not being the result of any communication with the sensorium; in not exhausting excitability; and in the permanency of its effects. The movements constituting muscular contraction are the consequence of impressions conveyed to the brain through the sensitive nerves, and thence to the motor nerves of the part: the contractions following the application of Astringents are the result of direct impressions on the ultimate fibrils of the motor nerves, although unconnected with those of sensation.

Let us now examine the manner in which this class of medicines operate upon the principal organs of the body.

1. *Action of Astringents upon the Digestive Organs.*—When a moderate Astringent is taken into the stomach, it acts upon the nerves of the organ, shortening the muscular fibres, not only of its tunics, but those of its blood vessels, lessening the capacity of the viscus, and giving density to its coats; this operation upon the moving fibres is tonic: but, if the Astringent be a powerful one, or the dose large, a painful sensation of constriction in the organ is experienced, and its local impression is felt over all the internal organs. The mucous membrane of the alimentary canal becomes comparatively dry, from its usual exhalations being diminished; and costiveness is the result.

2.—*upon the Circulating and Respiratory Organs.*—When Astringents are taken into the circulation, the circular fibres of the arteries are shortened, the diameter of the vessels diminished, and the power, both of these and of the heart, augmented; so that the pulse feels firmer and tenser; but, nevertheless, the circulation is not accelerated; or, in other words, a tonic effect is the result. It is to this contraction of the vessels, and their increased density, that may be justly attributed the power of Astringents in hæmorrhages of internal organs, such as the bladder of urine and the kidneys, to which they are most probably directly applied. In relaxation of the mucous membrane of the bronchial tubes, and a superabundant excretion of mucus into the cells, the influence of Astringents becomes strikingly obvious; and can only be explained on the supposition that the astringent is absorbed, and acts upon the muscular coats of these tubes and cells.

3.—*upon the Secerning System.*—From what has been said, it is evident that Astringents diminish, to a certain extent, the secretions; but most particularly the secretions of the kidneys. When the extreme vessels through which the urine filters into the papillæ of the kidneys are in a state of great relaxation in

diabetes, there can be no doubt that any benefit derived from Astringents, in this state of the urinary organs, can only be referred to the direct application of the Astringent to the relaxed vessels. Astringents, indeed, it is well known, lessen the quantity of the urine, but they do not alter the saccharine constitution of diabetic urine.

4.—*upon the Nervous System.*—Little requires to be said upon this part of our subject; for although it cannot be denied that the impression made by Astringents on the nerves of the stomach is communicated through the medium of the nerves to every part of the system, yet, this influence approaches more to that exerted by a tonic power than one purely astringent. It is no argument against the correctness of this opinion, that a few grains of acetate of lead, taken into the stomach, will restrain an internal hæmorrhage; for, in this instance, the influence of the salt of lead is probably to be ascribed rather to the diminished energy of the circulation which follows its administration, than to any astringent property inherent in the preparation. Indeed, several substances usually regarded as Astringents, and undoubtedly capable of checking hæmorrhages, produce their effects in the manner just explained—by a sedative impression on the nervous system, diminishing the action of the circulating organs.

All substances regarded as Astringents operate by one or other of the modes which have been described in the foregoing remarks: I have, therefore, founded upon them the principal divisions of the table of Astringents. In the first division, I regard the substances arranged in it as—1. Producing an effect closely resembling that of *tone*, although I am satisfied that the influence of *simple Astringents* and that of *simple Tonics* differ in several respects; yet, as Astringents may be substituted for Tonics in some diseases of debility, and a few of them have the power of cutting short the paroxysm of ague, if given a short time antecedent to its accession, I have adopted the term *tonic*, for want of a better. 2. Exerting a *sedative power*. On this subject I would add, that, although a sedative power is capable of checking a hæmorrhage, by diminishing the impetus of the vascular system, yet, the substances placed under this head act primarily as local Astringents, by corrugating the extreme fibrils. To illustrate this by an example, let us suppose a *diarrhœa*, arising from acrid bile flowing into the duodenum:—an ordinary sedative administered under these circumstances would lessen the irritability of the intestines, and consequently render them less susceptible of the impression of the acrid matter; but a sedative Astringent would more certainly check the diarrhœa, by not only diminishing the susceptibility of impression, but, by its astringent influence, repressing the flow of the excretions of the canal itself, and also that of the acrid bile into it. 3. Exerting a chemical influence on the contents of the intestines.

TABLE OF ASTRINGENTS.

A. TONIC ASTRINGENTS.

* *Organic Products.*

a. TANNIC ACID—contained in

Galls, in	Quercus *tinctoria*	21.	7.	Cupuliferæ.
	* Terminalia *Chebula*	10.	1.	Combretaceæ.
Roots of	Krameria *triandra*	4.	1.	Polygalaceæ.
	Rumex *aquaticus*	6.	3.	Polygonaceæ.
	* ——— *crispus*	-	-	———
	* Agrimonia *Eupatoria*	10.	1.	Rosaceæ.
	Polygonum *bistorta*	8.	3.	———
	Geum *Urbanum*	12.	5.	———
	* ——— *rivale*	12.	5.	———
	* ——— *Canadense*	—	-	———
	Potentilla *Tormentilla*	15.	5.	———
	* ——— *reptans*	12.	5.	———
	* Rubus *villosus*	12.	3.	———
	* Nymphœa *alba*	13.	1.	Nymphœaceæ.
	* ——— *odorata*	—	-	———
Plant	Lythrum *Salicaria*	11.	1.	Lythraceæ.
	* Boletus *Ignarius*	24.	13.	Fungaceæ.
Bark	Quercus *pedunculata*	21.	7.	Cupuliferæ.
	* ——— *coccifera*	21.	7.	———
	* Terminalia *alata*	10.	1.	Canbrotaceæ.
	* Cedrela *Toona*	10.	1.	Credrelaceæ.
	* Chickrassia *tabularis*	16.	2.	———
	* Elœodendron *Roxburghii*	5.	1.	———
	* Breidelia *spinosa*	5.	3.	Euphorbiaceæ.
	* Evodia *febrifuga*	5.	1.	Rutaceæ.
	* Butea *frondosa*	17.	3.	Leguminosæ.
Leaves	Arbutus *Uva Ursi*	10.	1.	Ericaceæ.
	* Agrimonia *Eupatoria*	11.	2.	Rosaceæ.
Flowers	Rosa *Gallica*	12.	5.	———
Fruit	Prunus *spinosa*	12.	1.	Amygdaleæ.
	Punica *Granatum*	12.	1.	Myrtaceæ.
	* Terminalia *belerica*	10.	1.	Combretaceæ.
	* Persea *gratissima*	13.	1.	Lauraceæ.
Secretions	Pterocarpus *erinaceus*	17.	1.	Leguminosæ.
	* ——— *Marsupium*	—	-	———
	Acacia *Catechu*	17.	1.	———
	* ——— *ferruginea*	16.	3.	———
	* ——— *leucophlæa*	16.	3.	———
	* Diospyrus *melanoxylon*			Ebenaceæ.

Eucalyptus *resinifera*	17. 1.	Myrtaceæ.
* Calamus *Draco*	6. 3.	Palmaceæ.

b. HEMATINE—

Hæmatoxylon *Campechianum.*	10. 1.	Leguminosæ.

*** Inorganic Substances.*

c. ACIDS—
Sulphuric Acid.
Acetic Acid.
Gallic Aid.

d. METALLIC SALTS—
Alum.
Sulphate of Iron.
Hydrochlorate of Iron.
Sulphate of Copper.
Sulphate of Zinc.
Acetate of Zinc.
Nitrate of Silver.

B. SEDATIVE ASTRINGENTS.

** Ponderable.*

e. METALLIC SALTS—
Carbonate of Lead.
Acetate of Lead.
Diacetate of Lead.

*** Imponderable.*

f. COLD, through the medium of
Water.
Evaporating Lotions.

C. SUBSTANCES OPERATING CHEMICALLY AS ASTRINGENTS.

g. CARBONATE OF LIME.

A. TONIC ASTRINGENTS.

** Organic Products.*

a. TANNIN, TANNIC ACID, is a peculiar vegetable principle. It receives its name, Tannin, from the circumstance of its forming the principal agent in the operation of converting the skins of animals into leather; a process in which this principle, as obtained from various astringent vegetables, is precipitated upon the gelatin of the skins from water in which it is held in solution, and in which the skins, properly prepared, are placed: they

are thus rendered impermeable to moisture, and capable of resisting putrefaction under the ordinary circumstances which favour it in untanned animal matters. This process is termed *Tanning;* hence, the French chemists named the principle on which it depends, *Tannin.* It is an acid, and is now named *Tannic Acid.* It is a component of most astringent plants: and some diseased excrescences of such plants; as, for example, Galls.

According to M. Pelouze, Tannic Acid is procured by introducing powdered Gall-nuts into a tube closed at one end with a linen rag, and pouring over them sulphuric ether. The lower end of the tube is then inserted in a common jar or bottle. The ether gradually yields its water to the Tannic Acid, and forms with it a thick syrup, which is pushed into the bottle by the expansion of the ether above it. This syrup, which consists of water, ether, and Tannic Acid, being evaporated, leaves the latter in a state of purity. M. Pelouze says that 100 parts of gall-nuts yield 40 of Tannic Acid.

Tannic acid has been rarely procured in a state of purity. It is found chiefly in the inner bark of the roots and the stem of trees; sometimes it is contained in the wood, occasionally in the petals of the flowers, varying in character in different plants, owing to its combination with other principles. It has been employed, in its pure state, in uterine hæmorrhages; and M. Cavalier says it has succeeded in stopping these when many other Astringents have failed. He gives it in doses of two grains every two hours. For this purpose it can be procured sufficiently pure from a solution of catechu in cold distilled water, filtered and evaporated to dryness. Tannic Acid, exposed to the air for some weeks, is oxidized and converted into Gallic Aid.

Galls. *Gallæ.* L. E. D.—The leaves of the oak, of every species, and those of some other plants, display small excrescences on the petioles, produced by an insect; but the officinal Gall is found only on the Quercus *infectoria.* It is the result of the puncture of the Cynips *Quercusfolii* (*Diplolepsis Gallæ-tinctoriæ*), which deposites its eggs in the puncture. It is a small hymenopterous fly, with a fawn-coloured body, dark antennæ, and the upper part of the abdomen of a shining brown colour. The ovipositor, as it is termed, of the female, is long, slender, articulated, and so flexible that it is rolled up spirally, and concealed within the abdomen, when the insect is not using it: but it is so admirably constructed that it can be run out and made stiff and firm at the pleasure of the insect. With this little instrument the insect punctures the petiole of the oak-leaf, and deposites in the puncture an egg, too small to be seen by the naked eye, and probably, also, a drop of some irritating fluid. In a few hours, the irritation which is induced in the part causes an afflux of

fluids to it: the Gall rises, and in a day or two attains its full size. It is puzzling to conceive how the insertion of so minute a body as the egg of the Cynips should cause so singular a divergence from the ordinary growth of the part. The simple puncture, and the mere mechanical irritation, are not sufficient to explain the phenomenon in a satisfactory manner: I am, therefore, disposed to think that some acrid secretion is injected from the ovipositor along with the egg, which, acting locally, like any other acrid lymph, which, in the animal body, produces a specific change in the structure of the part, is the chief cause of the irritation. Not the least singular circumstance is the rapidity of the growth of the Gall, which, however large, attains its full size in a couple of days: and this is another reason for supposing that there is some fluid injected along with the egg, as the larva is not yet hatched. After a certain period, the egg enlarges, the larva is hatched, and derives its nourishment from the Gall; after some time, it eats its way out of its prison; which then becomes lighter, and contains much less of the astringent principle: the Galls, therefore, that have a hole in them, are less valuable than the entire Galls. The best Galls are gathered before the fly has issued from them; and from Galls of this kind very perfect specimens of the insect are frequently procured*.

The Oak on which the best Galls are formed is the Quercus *infectoria*, a small tortuous tree, a native of Asia Minor, which belongs to the natural order *Cupuliferæ*†; and is well described by Olivier‡. Never more than one ovum is deposited in the Gall; this fœtal habitation being what entomologists term monothalmous.

The best Galls are those of Aleppo, Smyrna, Magnesia, and Natolia: they are termed *black*, *green*, or *blue* Galls: those through which the insect has eaten its way out, are called *white Galls*. The Galls formed on the Quercus *Robur*, *Cerris*, and other species of Oak in this country, are small, smooth on the surface, polished, reddish, and are not used§.

Galls are nearly globular in their form, varying in size, from that of a pea to that of a large hazel-nut, and studded with tuberosities: they should be of a blackish-blue, or very deep

* A different insect, a species of the genus *Chalcis*, is also sometimes found in the Gall-nut; but this is the larva of a parasitic fly, which punctures the Gall in its green state, deposites its egg in the body of the larva of the Gall-fly, and destroys it.

† Woodville's Med. Bot. third edit. p. 23, pl. 10. Richard, Hist. Nat. Med. t. i, p. 444. Lindley, 291. Hayne, xii, 45.

‡ Olivier, Voyage dans l'Empire Ottoman.

§ Some Galls, on other plants, are formed by beetles; such, for example, is that formed on the wild mustard, Sinapis *Arvensis*, by the Curculio *contractus*. Others are formed by Tipulæ, as those on the ground ivy and wild thyme. Galls, powerfully astringent, are found on the Terminalia *Chebula*, a native of Bengal.

olive colour, heavy, compact, brittle, breaking with a flinty fracture; and their internal structure crystalline. They yield the whole of their active matter to water; the residue being inert and insipid. Alcohol and Ether also take up a considerable portion of the active principle. They contain a large quantity of tannic acid. The aqueous infusion reddens litmus. Sir H. Davy found 25 per cent. of tannin, 6·2 of gallic acid* and extractive, 2·4 of mucilage, and 2·4 of saline and earthy matters, in Galls: but Royer states that he obtains 125 grains of pure gallic acid from 500 grains of the Galls: and Dr. Duncan thinks that Sir Humphrey has estimated the quantity of tannin too low: in one experiment, with 500 grains of Gall-nuts, Duncan obtained 220 grains, and, in another, 256 grains of soluble matter.

The chemist who has most successfully examined Galls, is Pelouze, who has obtained from them, by means of Ether, from 40 to 60 per cent. of Tannic Acid. He recommends the process already described (p. 660); but the acid is more easily procured by a process recommended by M. Leconnot, namely, to macerate the powdered Galls in Ether, and submit the pulp to the action of a strong press: repeating the process on the marc several successive times, until the gall-powder is exhausted, and then uniting the solutions, distilling off a portion of the ether at a low heat, and evaporating the residue in a water bath.

Tannic acid, when pure, is nearly colourless, apparently but not regularly crystallized, inodorous, and powerfully astringent to the taste. It is unalterable in the air, and is easily pulverized. It is a true acid, capable of decomposing the alkaline carbonates with effervescence, and forming tannates with oxides. It dissolves readily in water; and is soluble in alcohol and ether. When exposed to the air in solution for a considerable time, it absorbs oxygen, which changes it into gallic acid. It is a curious fact, that, although Tannic acid is a real acid, yet it is precipitated from its solution by Nitric, Phosphoric, Hydrochloric, and Arsenic acids. Protosulphate of iron produces no alteration on the solution of pure Tannic acid; but the sesquisulphate immediately precipitates it, in combination with the oxide, of a deep bluish-black colour; if an excess of the solution be added, what remains undecomposed of the sesquisulphate is converted into the protosulphate, owing to the Tannic acid attracting the oxygen. The Tannic acid of Galls forms an insoluble compound with gelatin. The precipitate is a compound of—Gelatin 54 + Tannic acid 46 = 100; and is known under the name of *Tanno-Gelatin*. It affords a pretty accurate test of the quantity of Tannic acid contained in any astringent vegetable infusion or

* Pelouze imagines that the gallic acid results from some change produced on the tannic acid by the process; and that it does not exist ready formed in the Galls.

decoction. If an excess of the solution of gelatin, however, be added to the vegetable infusion, the precipitate is re-dissolved. Lime water and barytic water precipitate Tannic acid from its solution, the precipitate being a compound of the earth and the acid: but when the earth is separated by an acid, the freed Tannic acid again acts upon gelatin. It also precipitates all the salts of Quina, Morphia, Strychnia, and the other alkaloids, from their solutions. From the analysis of Berzelius, the constituents of Tannic acid appear to be—Hydrogen 4·186, Carbon 51·160, Oxygen 44·654, in 100·000 parts: but, according to Liebig, it consists of 51·17 Carbon, + 44·09 Oxygen, + 4·12 Hydrogen, or 18 eq. of Carbon, + 12 Oxygen, + 8 Hydrogen, equiv. = 216·16. ($C.^{18}$ $H.^{12}$ O^{5}.)

Braconnot has discovered in Galls a new acid, which he has called *Ellagic*, a word derived from reversing the word *Galle*, in French, and adding the syllable *ic*—a singular and whimsical innovation in nomenclature. This acid possesses peculiar properties, is insipid, inodorous, white, with a slight tinge of red; and is insoluble in boiling water, on which account it is readily separated from gallic acid in the process of obtaining it. When Ellagic acid is mixed with nitric acid, and gently heated, the mixture acquires a red hue, and ultimately becomes blood-red: it is owing to the presence of this acid, therefore, that nitric acid, added to the infusion of Galls and of Oak-bark, produces a blood-red colour. In the infusion of Galls, the application of heat causes the partial decomposition of the nitric acid, nitrous fumes are emitted, and both the gallic and the ellagic acids are converted into oxalic acid.

In preparing Galls for medicinal purposes, it is of importance to obtain the astringent matter as free from the other ingredients* with which it is combined as possible: the Galls should, therefore, be simply infused in distilled water, of a temperature not exceeding 180°: this takes up little more than the tannic acid; but when the galls are boiled, the starch is partly converted into a *tannate*, which precipitates as the decoction cools*.

The incompatible substances with infusion or decoction of Galls are very numerous. Many substances form precipitates with these preparations besides those which indicate the astringent character of the Galls. Thus the infusion is precipitated by infusions of Cinchona, Cusparia, and Calumba; solutions of Opium, Lime-water; Carbonate of Potassa; the Acetates of Lead; sulphates of Copper and of Iron; nitrate of Mercury and of Silver, and Potassio-tartrate of Antimony; all of which are, therefore, incompatible in prescriptions with it. The sul-

* The infusion in cold water is a very delicate test of the presence of iron in any liquid; and it is also an excellent test of the presence of morphia.

phuric and hydrochloric acids cause flaky, white precipitates: nitric acid changes the colour, first to deep orange and then to pale orange or yellow; and the astringency of the infusion is also greatly weakened. Although the nitrate of mercury throws down a clotted, bright-yellow precipitate, yet the bichloride, which is more likely to be ordered, in conjunction with the infusion of Galls, only renders the infusion milky. It is curious that so copious a decomposition of tartar emetic should take place on the addition of the solution of that salt to infusion of Galls, when no precipitate is produced by it in decoction of oak bark. No precipitates are thrown down with infusion of Quassia, Gentian, Canella alba, Orange-peel, Saffron, Ammonia, Sulphate of Zinc, and Bichloride of Mercury; which may, therefore, enter into the prescriptions with infusions of Gall-nuts. By distillation per se, Galls have been found to yield a concrete volatile oil, which Professor Branchi, the discoverer, regards as a component of Galls: but I am inclined to consider it the production of the operation*.

As an Astringent, Galls possess all the properties which can be expected from medicines of an astringent character; they are, nevertheless, seldom used as internal medicines in this country. They enter the circulation, but previously produce a primary styptic influence upon the stomach, which, when the dose of the medicine is large, greatly incommodes the organ; hence, when internally administered, they are combined with other substances, usually with aromatics. For external application, in the form of gargles, lotions in leucorrhœa, and as ointments, their use is most extensive.

Tincture of Galls. *Tinctura Gallæ*, L. *Tinctura Gallarum*, E. D.—The proportion of powder of Galls differs in the Pharmacopœias of the three British Colleges. The London College orders ℥v to Oii of Proof Spirit; the Edinburgh, ℥ii to Oi of Proof Spirit; and the Dublin, ℥iv to Oi of Proof Spirit. The Edinburgh Tincture is made by percolation. It is a spirituous solution of tannic acid.

Compound Ointment of the Gall, *Unguentum Gallæ compositum*, L. *Unguentum Gallæ et opii*, E. is an admixture of ʒii of powdered Galls and ʒss (ʒi, E.) of Opium in powder, in ℥ii (℥i, E.) of Lard. The Dublin College orders an Ointment of Galls, *Unguentum Gallarum*, to be made with ℥i of fine powdered Galls and ℥iv of prepared Lard.

For internal purposes, the Powder is certainly the best form of administering the medicine. The dose may be from gr. v to ℈i. It is almost unnecessary to remark, that Galls ought not to be powdered in an iron mortar.

* A solution of Galls in ether is the most delicate test of the presence of salts of iron.

* *Roots.*

ROOT OF KRAMERIA TRIANDRA, RATANHY*. *Krameria.* L. E. D.—The plant of which this is the root belongs to the natural order Polygalaceæ†. It is a native of Peru, growing in arid and sandy places in several of the provinces; but most abundantly near the city of Huanuco. Another species of the same genus, Krameria *Ixina*, a native of the Antilles, furnishes roots very similar in their appearances to those of K. *triandra*‡. The root is named Ratanhia in Peru, and is the part of the plant medicinally employed. It is in pieces of various thickness, consisting of a root-stock, and several usually branched roots, of a dark-red colour, breaking short, and exhibiting in the fracture a woody centre, and an easily separated, fibrous bark, which contains the active part of the root, the woody part being completely inert. On this account, in choosing Ratanhy Root, the roots about the thickness of a Swan's quill are to be preferred, as in these the bark is comparatively thicker than in the larger roots.

The bark of Ratanhy Root has a bitter, astringent taste, at first nauseous, but afterwards sweetish. The odour is earthy, and this is also the case with the decoction, which smells not unlike raw potatoes. The bruised root yields to cold water, boiling water, alcohol, and proof spirit, its active principle The colour of the infusion is deepened by the pure alkalies; but no precipitate is thrown down. The infusion made with boiling water becomes turbid on cooling, but that with cold water remains clear; with bichloride of mercury the precipitate is flesh-coloured; and, with acetate of lead, greyish-yellow; with the sesqui-sulphate of iron, greenish-brown; with the persulphate, a deep black-green; with isinglass solution a dirty-white, with lime water a pinkish precipitate. Boiling water takes up the tannic acid, fecula, and extractive, and forms the tannate of starch which is precipitated as the infusion cools; the tannic acid and some colouring matter only is taken up by cold water. These reagents demonstrate that Ratanhy root owes its astringency to tannic acid. Alcohol digested on it takes up the colouring matter of the root, and part of its tannic acid; and also detects the presence of resin, which is slowly separated when the tincture is poured into water. According to Vogel, the constituents of 100 parts of this root are—40 of a peculiar prin-

* The name *Ratanhia*, in Huanuco, signifies "spreading:" in some provinces the plant is called *Mapato*, villous or tomentose, the young shoots being white and silky; in other places it is called *Pumacuchu*.

† Woodville's Med. Bot. third edition, vol. v, p. 129. London Dispensatory, art. Krameria. Richard, Hist. Nat. Med. t. ii, p. 754. Lindley, 128. Hayne, vol. viii, p. 14

‡ The term triandra arises from one of the stamens being always suppressed.

ciple, which he names modified tannin; 1·50 of mucilage; 0·50 of fecula; 48·00 of fibrin; and 10·00 of water and loss: but this analysis is not to be depended on, as it mentions neither resin nor pure tannic acid, both of which are certainly constituents of Ratanhy root. Tromsdorff found it to consist of 42·8 of tannic acid, + 17·5 of dark-brown gum, + 15 lignin, + 25 bitter extractive, = 100·0. M. Peschier of Geneva has stated that he has detected a peculiar acid in this root, which he names the Krameric; but its existence is doubtful *, and has been denied by M. Chevalier †.

As an Astringent, this root is a valuable remedial agent. The Peruvians employ it in dysentery; they long employed it as a tooth-brush, to give a firmness to the gums and impart a fine red to their lips; hence the Spanish name of the plant, Ruiz para los dientes. In combination with purified animal charcoal, in the proportion of one part to three of the charcoal, it forms the best tooth powder that can be produced. It is not yet much employed as a medicinal Astringent. The dose of the root, in substance, is from gr. x to ʒii: the best form of giving it is in infusion or decoction, and extract. A tincture is also prepared with it, which contains all the tannic acid, and, of course, all the active matter of the roots.

Infusion of Krameria, *Infusum Krameriæ*, L. is made with ℥i of the bruised root and a pint of distilled water, infused for four hours and strained.

Salts of iron, acetate of lead, the mercurial salts, tartar emetic, and the mineral acids, except in small quantity, are incompatible in prescriptions with infusion of Krameria. But as the alkalies merely deepen the colour, they may be combined with it: a great advantage indeed, in those cases of dyspepsia in which a direct bitter is not required; and in calculous affections of the kidneys. As in the case of other astringent vegetables, ipecacuanha is incompatible with infusion of Krameria.

When the Infusion of Ratanhy is taken into the stomach, it tinges the fæces of a red colour, which continues for some days after the use of the medicine is discontinued. It does not affect the urine. When it is taken daily for some time, it is productive of uncomfortable sensations—sickness, pains in the lower belly, and costiveness; sometimes tingling over the whole skin; flying pains in the limbs, and even spitting of blood. In diarrhœa, if irritation or subacute inflammation exist in the intestinal canal, Ratanhy often produces heat of the epigastrium, thirst, cardialgia, sometimes vomiting and flatulence. These symptoms, however, and also the diarrhœa, gradually abate, the appetite returns, and the salutary influence of the remedy be-

* Journ. de Pharm. t. vi, p. 45. † Dict. des Drogues, t. i, p. 122.

comes apparent: but when they increase in violence, then the medicine should be discontinued. Administered in diabetes, it diminishes the quantity of urine; but the morbid qualities of the secretion remain unaltered. The dose of the infusion is f℥iss to f℥iii.

Extract of Krameria, *Extractum Krameriæ*, E. is made by reducing the root to small chips, and afterwards to powder, which is to be mixed with half its weight of distilled water, and in twelve hours put into a percolater, and tepid distilled water passed through it to exhaustion. The fluid is then to be concentrated, filtered, and evaporated to a due consistence in a water bath.

The root yields a ninth of its weight of Extract: but it is preferable to use the bark only, which, according to Guyer, yields one-third of its weight. This extract contains all the active matter of the root. The dose is ℈i to ℈ii.

Great Water Dock. *Rumex Aquaticus*. D.—This is an indigenous perennial plant, found in ditches and on the banks of streams. It belongs to the natural order *Polygonaceæ**. The roots of this Dock are large, branchy, break with a starchy fracture, and exhibit a white centre, whilst the cortical part is pale yellow, covered with a reddish-brown cuticle. It has a faint, peculiar odour, and an austere, bitter taste. It yields its virtues to water. The decoction strikes a black with sesquisulphate of iron, and throws down a precipitate with lime and barytic waters; iodine demonstrates the presence of a very considerable proportion of fecula in it. Gelatin detects tannic acid, and protochloride of tin extractive. According to the experiments of Deyeux, it contains a large proportion of free sulphur.

In full doses, the decoction of this root purges; but, in small doses, it operates as an Astringent. It was formerly in great repute as a remedy in cutaneous affections. In every old author who treats of skin diseases, we shall find it described under the names *Lapathum, Hydrolapathum,* and *Herba Britannica;* and it is still recommended as a specific in various species of dartres on the Continent.

The most useful of all our indigenous remedies in cases of Ichthyosis, for which it is almost a specific, is another species of Rumex, much more common and generally known than the *aquaticus,* namely, the Rumex *obtusifolius.*

The decoction of the root of this plant is bitter and nauseous, and less astringent than that of the Rumex *aquaticus*. It appears, from the action of reagents, to contain tannic acid, extractive, starch, and a bitter principle; but it also contains

* Woodville's Med. Bot. third edit. p. 658, pl. 229. London Dispensatory, art. Rumex. Richard, Hist. Nat Med. t. i, p. 507. Hayne, xiii, 4.

some purgative matter, as it operates powerfully on the bowels. The dose of the decoction, made with an ounce of the root and one pint of water, is f℥iss twice or thrice a day.

Root of Bistort. *Polygoni Bistortæ Radix.* D.—This plant, named from the form of the root, which is twice turned, *bis torta*, belongs to the natural order Polygonaceæ*. It is very widely diffused, being found over the greater part of Europe and Asia, in all elevations, in the low, marshy grounds of this country, and on the Carpathian Alps, at a height of 4476 feet.

The dried root of Bistort is inodorous, and has an austere, acerb taste: its decoction indicates a free acid, by its action on vegetable blues; and we conclude that it is tannic, as it blackens the salts of iron, and precipitates gelatin: the tincture of iodine detects fecula; and the protochloride of tin throws down extractive. Besides the tannic acid, fecula†, and extractive, this root contains also some oxalic acid, which throws down a copious precipitate with lime water.

The astringent powers of Bistort root are considerable; and applicable to all cases in which simple Astringents are required. The fecula and extractive are disadvantageous in keeping the decoction, and in forming what may be termed an elegant mixture; but the emollient properties which these confer upon it render it an admirable local Astringent in leucorrhœa and other mucous discharges from the vagina. It is very seldom employed in modern practice, probably from the circumstances to which I have alluded, and partly from the uncertainty of its powers, owing to the modifying influence of soil and climate. Thus, from the formation of a greater proportion of fecula and less tannic acid in the climate of Iceland, the natives of that bleak country eat the Bistort root, both raw and converted into bread.

The dose of powdered Bistort root, the best form in which it can be administered, is from fifteen grains to a drachm. It may be advantageously combined with aromatics.

Avens. *Geum Urbanum.* D.—I have already described this plant; therefore it is unnecessary again to enter into any details respecting it. It is seldom employed as an Astringent.

Tormentil. *Tormentilla.* L. E. D.—This is the root-stock of Potentilla *Tormentilla,* a common, indigenous, perennial plant, belonging to the natural order Rosaceæ‡. The root-stock

* Woodville's Med. Bot. third edit. p. 668, pl. 232. London Dispensatory, art. Polygonum. Richard, Hist. Nat. Med. t. i, p 502. Lindley, 361.

† The quantity of fecula is so great, that the poorer classes of the people in Siberia employ it as food, after it has been submitted to decoction in water, to extract the bitter and astringent principle.

‡ Woodville's Med. Bot. third edition, p 503, pl. 181 London Dispensatory, art. Tormentil. Richard, Hist. Nat. Med. t. ii, p 429. Lindley, 225. Hayne, vol. ii, p. 48

is thick, oblong, tuberculated, of a dark brownish red colour exteriorly and pinkish within; it is inodorous, and has a very astringent, bitter taste, accompanied with a slight aromatic flavour. When distilled in water, it imparts to the fluid the odour of the rose. According to the analysis of Dr. Meissner of Berlin, 1000 grains of the root of Tormentil yield—myricine, 2 grains; cerine $5\frac{1}{8}$; resin $4\frac{1}{4}$; tannic acid 174; red colouring matter (extractive?) $180\frac{1}{3}$; red colouring matter modified $25\frac{3}{4}$; gum 282; gummy extractive, united with some tannic acid and a calcareous salt, $43\frac{1}{4}$; extractive 77; volatile oil, traces; and ligneous fibre and water $206\frac{1}{2}$. Dr. Meissner gives us no idea of the nature of the red colouring matter, or *rouge de tormentille*, as he terms it; and it is not easy to understand what he means by the two kinds of extractive. The proportion of tannic acid appears small in reference to its astringent powers. A precipitate is formed of the tannic acid with lime water; and, as this is inert, lime water and chalk mixture are incompatible in prescription with Tormentil root. If it be requisite to combine so useful and powerful an Astringent with the chalk mixture, the Tormentil root should be in a state of powder*.

Decoction of Tormentil, *Decoctum Tormentillæ*, L. is made with two ounces of the bruised root, and a pint and a half of distilled water, boiled down to a pint, and strained.

Decoction is the best form of administering Tormentil. It is chiefly useful in cases requiring the employment of Astringents, in which there exists an atony of the system, unconnected with any source of irritation. It is so little stimulant, that the presence of febrile excitement does not stand in the way of its administration. It operates powerfully as a topical Astringent, and as such destroys warts. A rag dipped in a strong decoction, and laid over the warts, acts on the warts nearly in the same manner as on dead animal matter; the vitality of these growths being in a low state, and incapable of resisting the chemical action of the Tormentil. On the same principles may be explained its utility as an injection in polypus of the uterus. The dose of the powdered root is from ℈ss to ℈i; that of a decoction, made with ℥i of the bruised root and a fluid pint of boiling distilled water, from f℈x to f℥ii.

* * *Plants.*

Purple Loosestrife. *Lythri Salicariæ Herba.* D.—This is an indigenous, perennial plant, growing in marshy places, and on the banks of rivers, flowering from June till September,

* Except nut-galls and catechu, Tormentil root contains more of the vegetable astringent principle than any other vegetable production; and on this account is employed in the Orcades in tanning leather.

belonging to the natural order Lythraceæ*. In its dried state it has an herbaceous, subastringent taste, and evidently contains tannic acid, from the action of its decoction on the salts of iron. It was formerly employed in diarrhœa and dysentery, in which it was strongly recommended by Stoërck and de Haen; but it has deservedly fallen into disuse, and is retained only in one British Pharmacopœia, that of the Dublin College. It may be administered in powder, in doses of from ʒss to ℈iv, or in decoction, made with two ounces of the root and a quart of water boiled down to one pint, in doses of two or three fluid ounces.

* * * *Barks.*

Oak Bark. *Quercus.* L. *Quercus Cortex.* E. D.—This noble tree, the pride of our forests, from which we derive much of our national importance as a commercial people, and which floats, the bulwarks of our maritime glory, the "knotty, unwedgeable, and gnarled Oak of England," belongs to the natural order Corylaceæ or Cupuliferæ†.

It is curious to trace the history of the Oak. It was held sacred by the Greeks, the Romans, the Gauls, and the Britons. At an early period it was cultivated in Britain as a fruit tree, and the failure of an acorn crop was accounted a cause of famine‡. After this period, the acorn was still of great importance to the large herds of swine which constituted much of the wealth of our Saxon ancestry, who felt more the power of tyranny in the conversion of their forests into hunting grounds, than in all the other acts of the Norman Conqueror. Some of the aboriginal Oaks long remained to attest the great age to which this noble tree reaches: and some still exist upwards of one thousand years' old§. The size to which the Oak occasionally attains is no less remarkable. It sometimes acquires

* Woodville's Med. Bot. third edit. vol. v, p. 56, pl. 19. London Dispensatory, art. Lythrum. Lindley, 150. Hayne, iii, 39.

† (Quercus robur) Woodville's Med. Bot. third edit. p 23, pl. 10. London Dispensatory, art. Quercus. Richard, Hist. Nat. Med. t. i, p. 444. Lindley, 291. Hayne, iv, 36.

‡ Some of the species of Quercus, the Quercus *Ilex*, and some of the species of South American growth, produce acorns which are mild and nutritive; and even the kernels of the common oak might be rendered edible by boiling them in the alkaline ley, were it necessary, in any period of famine, to resort to them as food. They contain 38 per cent. of fecula, 9 of tannic acid, 6·4 of gum, 5·2 resin, 5·2 bitter extractive, and 4·3 concrete oil, besides lignin and salts. (Löwig, quoted by Christison, Dispensatory.)

§ Bull Oak, Wedgenock Park, Warwickshire, is said to be near 1000 years of age; the great Salcey Forest Oak was 1500 years old in 1794; and the Bentley Oak was as old.

nearly forty feet in circumference and one hundred feet in altitude*.

This officinal species has been confounded with the Quercus *robur*, which, however, differs from it in having the fruit or acorns sessile; whereas, in the officinal Oak, they are supported on peduncles, or rather pedicels, from one to two inches long, whence the trivial name *pedunculata*.

Although every part of the Oak is astringent, yet the bark of the smaller branches, which are peeled in the spring, is the only part officinally used. Oak bark is covered with a bluish-grey epidermis, and is of a pale cinnamon or fawn colour within: is brittle and fibrous in its texture. In spring, it contains eight per cent. more of astringent matter than in the autumn. The bark is inodorous, and has a rough, astringent taste. The portion richest in tannin has been ascertained, by Sir H. Davy, to be the inner cortical part. He found that ℥i of this part yields 77 grains of tannin *(tannic acid)*; that the cellular integument, or middle coloured part, yields 19 grains only; and the epidermis scarcely any quantity, either of tannic acid or extractive†. Besides containing *tannic acid*, protochloride of tin displays also extractive in the decoction‡, which is precipitated by lime water, carbonate of potassa, and acetate of lead; but Vauquelin ascertained, what is remarkable, that no precipitate is produced by the solution of tartar emetic, or the infusion of yellow cinchona bark.

Oak Bark is a valuable Astringent, whether administered internally or applied externally; and may be used, either generally or topically, in all cases requiring Astringents.

Decoction of Oak Bark, *Decoctum Quercus*, L. E. D. is made by boiling down ʒx of the bark in Oii of water, to one pint, and straining. The best form of administering Oak Bark is that of decoction; for it can scarcely be reduced to powder. The dose of the decoction is from f℥i to f℥ii, twice or three times a day.

Extract of Oak Bark, *Extractum Quercus*, D. is prepared by boiling any quantity of the bark in eight times its weight of water, down to one half; then expressing, allowing the fæces to subside, and straining; and, lastly, evaporating, in a water bath, to the consistence fit for making pills.

* Moccas Park Oak is 36 feet in circumference, at three feet from the ground; Cowthorpe Oak, in 1776, measured 78 feet in circumference, three feet from the soil; and Damory's Oak, in Dorsetshire, 68 feet.

† The bark of the Quercus *alba*, of the North American States, contains a much larger proportion of tannic acid than that of the common Oak. An infusion of ℥ss in f℥xii of boiling water, taken in doses of f℥ii every third hour, has been found to check ague.

‡ It is owing to the extractive that the saw-dust of the Oak is employed as a dying material, to impart a fawn colour to cottons.

The astringency of a strong decoction of Oak Bark, when it is swallowed, is powerfully felt in the stomach, inducing, invariably, cardialgia and spasm when it is given alone: hence its internal employment is seldom resorted to; although the bark has been used in some of the Continental military hospitals as a substitute for cinchona bark, in the following combinations:

℞ Pulveris Quercus corticis	.	gr. 120
——— Gallarum	. . .	gr. 30
——— Gentianæ Radicis	.	gr. 35
——— Anthem. nob. flor.		gr. 20
——— Cetrariæ Islandici		gr. 5—Misce.

This powder is ordered to be given half an hour previous to the accession of the paroxysm of ague. It is said to have proved successful in many instances; but its bulk is a great objection to its employment, and the large proportion of Oak Bark renders it difficult to be retained on many stomachs.

The external application and topical use of the decoction is more frequent and beneficial than its internal administration. In prolapsus ani, in leucorrhœa, and in uterine hæmorrhage, it may be advantageously employed as a lotion and injection; and as a gargle, in those states of the fauces which indicate great relaxation of the mucous membrane.

This extract is less active than the decoction, perhaps owing to the conversion of the tannic acid by the long boiling into extractive.

* * * * *Leaves.*

Bear's Wortleberry. *Uva Ursi.* L. E.—Although, in treating of tonics, the leaves of this plant were mentioned (p. 587), yet, as an Astringent, several circumstances require to be noticed in this place. From the effect of the infusion, produced by simply triturating the leaves with cold distilled water, on persulphate of iron, I am of opinion that the proportion of tannic acid is greatly underrated in the analysis. The action of gelatin indicates the large proportion of it; and I am equally convinced of the abundance of extractive, from the effect of the addition of protochloride of tin to the infusion: oxalate of ammonia demonstrates the presence of lime: but, with the cold infusion, neither lime nor extractive are detected. Carbonate of potassa acts upon it nearly as on a solution of pure tannic acid, except that a slight precipitation takes place; and lime water throws down a tannate of lime—which is a fact of some practical importance.

As an Astringent, Uva Ursi possesses considerable powers: it is taken into the circulation, and may be detected in the urine forty-five minutes after it has been swallowed; and it is probable that, owing to this circumstance, it is found useful in chronic inflammation of the bladder. Sir B. Brodie says he has been disappointed in its use in this disease: but I have seen it serviceable

in several instances. To the absorption of it we may also attribute its effects in preventing the formation of urinary calculi in the kidneys. It was introduced into practice for this purpose by De Haen; who, with many others, ascribe its powers to some solvent property. Dr. Cullen referred them solely to the tonic influence of the remedy on the stomach, preventing the formation of acid in that viscus: but, although it certainly possesses no solvent powers, yet, as it enters the circulation, and is excreted by the kidneys, it is very probable that something is to be ascribed to its local influence as an Astringent on the kidney itself, in giving it tone, allaying inordinate action, and, consequently, producing a more healthy secretion and excretion than would otherwise take place in those conditions of the habit favourable to the formation of calculus. Dr. Smith Barton asserts that "it favours the expulsion of granules of calculi;" an effect that might be ascribed to its diuretic powers, which Alibert regards as its sole quality; "tout se reduit a dire," says he, in summing up its value as a medicine, "que le Raisin d'Ours a une action manifestement diuretique dans certaines circonstances." Its action on the kidney, however, is that of an astringent and a tonic: and, when the cold infusion is used, it is chiefly due to the tannic acid which it contains. In this infusion, it more directly passes into the circulation, and operates as a diuretic: but still there can be no doubt that some of the benefit derived from it, even as a diuretic, is due to its primary action on the stomach; particularly as it is generally administered in the form of powder. It is given, in powder, in doses of from one scruple to a drachm, or more: in decoction, made with one ounce of the leaves and one pint of water; or in infusion, made by rubbing in a mortar ℥ii of the leaves with a fluid pint of distilled water; the dose is f℥i to f℥iv. In this form, I have ordered it with great advantage in hæmorrhages of the bladder and of the prostate gland.

* * * * * *Flowers.*

h. Petals of the Red or French Rose. *Rosa Gallica.* L. E. D—The well-known and elegant flower requires no description: it forms the type of the natural order Rosaceæ*. It

* The beauty and fragrance of the Rose have given an interest to it in the eyes of every cultivated nation in the world; and in some Oriental countries the passion for it extends to a degree of luxurious indulgence that we can scarcely form any idea of in our phlegmatic climate. In Persia, it is common to recline on beds of roses in all their freshness; but the general result of such a voluptuous indulgence is a severe catarrh. Even in Morocco, as Mr. Jackson, in his account of that empire, informs us, the rich odoriferous petals of the Musk Rose are made up in mattresses for the men of rank to recline upon. It is extraordinary that, notwithstanding the permanency of its odour, the Rose furnishes so small a portion of volatile oil. At Lucknow, in Hindostan, where the best atter of roses is distilled, not more than three drachms are procured from a hundred weight of petals, freed from every other part.

is a native of Austria. The unblown buds yield the petals for medicinal use. This Rose has less fragrance than many of the other species of the genus; but the fragrance of the petals is increased by drying; and by the addition of iodine: the taste is agreeably bitter, and slightly aromatic. Boiling water extracts the odour, taste, colour, and astringent properties of Rosa *Gallica*. The infusion shews the presence of a free acid, which appears to be the tannic, from its effects on the sulphates of iron and gelatin: hydrochlorate of tin demonstrates the presence of much extractive. M. Cartier has published an analysis of this rose*. He found tannic and gallic acid, a colouring matter, a volatile oil, a fatty matter, albumen, soluble salts with bases of potassa, lime, silex, and oxide of iron. The astringent properties of the petals depends on the tannic acid which they contain†: the existence of the gallic acid is doubtful.

The influence of the petals of this Rose, as a remedial agent, is very moderate; although, at one time, they were in great reputation, and many imaginary virtues were attributed to them. They enter into several pharmaceutical preparations; namely, a conserve or confection, an infusion, a syrup, and a honey. All of these, with the exception of the honey, tend to constipate the bowels.

CONSERVE OF ROSES. *Confectio Rosæ Gallicæ.* L. *Conserva Rosæ.* E. D.—The London and the Dublin Colleges order one pound of the petals and three pounds of the pure sugar; the Edinburgh College, one part of the petals and two parts of sugar, to be beaten into an uniform mass. This confection has been much recommended in cases in which a gentle tonic and astringent is indicated; and, acidulated with sulphuric acid, in sweating connected with general debility of the system.

INFUSION OF ROSES. *Infusum Rosæ compositum.* L. *Infusum Rosæ.* E. *Infusum Rosæ acidum.* D.—The London and Edinburgh Colleges order ℥iii of the dried Rose petals, f℥iss of diluted suphuric acid, Oi of boiling distilled water, and ℥vi of sugar. The Dublin College orders ℥iii of the petals, f℥iii of diluted acid, three old wine-pints of boiling water, and ℥xii of sugar. The acid is put in after the petals have been infused, and the sugar added to the strained liquor. The infusion is an excellent vehicle for the administration of the disulphate of quina. As a gentle topical Astringent, the infusion, acidulated, is a

* Journal de Pharmacie, t. vii, p. 527.

† A curious effect results from the tannic acid which they contain acting upon iron. If the fresh petals of the Province Rose be beaten to a pulp, in an iron mortar, for some hours, they are converted into an intense black paste, which, being rolled into little beads, and dried, become so hard that they may be polished like ebony. Beads made in this manner are exported from Turkey to Catholic countries, under the name of rose beads or rose pearls, for the purpose of forming rosaries. They retain the odour of the flower.

useful gargle in affections of the fauces, and a collyrium in some species of ophthalmia.

Syrup of the French Rose, *Syrupus Rosæ Gallicæ*, L. is made with ℥ii of the Rose petals and ℥xx of pure sugar.

Honey of the Rose, *Mel Rosæ*, L. E. D. is made by adding to a strained infusion of ℥iv of the petals in Oiss of water, five pounds of Honey, evaporating to a proper consistence and removing the scum.

The Syrup and Honey of Roses may be indiscriminately used: they are both agreeable adjuncts to other preparations*.

* * * * * * *Fruits.*

i. Rind of the Fruit of the Pomegranate. *Granatum.* L. *Punica Granatum.* D.—The Pomegranate is well known in the conservatories of this country, and is even naturalized to our variable climate, although it does not bear fruit in the open air. It is a native of those shores which are bathed by the waters of the Mediterranean; hence its name *Punica,* imposed by the Romans, who first saw it in the neighbourhood of ancient Carthage. It is now cultivated in the milder regions of Europe, and in the East and West Indies, where the fruit is both larger and higher flavoured than in the native country of the plant. It belongs to the natural order Myrtaceæ†.

In England, the Pomegranate seldom grows beyond the magnitude of a shrub. The fruit is mentioned by Theophrastus and Dioscorides under the name of *Roa;* by Hippocrates under that of Σιδιον; and by Celsus it is termed *Punica Malum:* it is about the size of an orange, globular and crowned with the hardened remains of the calyx. The rind, which is the part employed as an Astringent, is coriaceous, of a reddish-yellow colour, brittle, inodorous, and having a very styptic, bitter taste. The pulp which it covers is succulent, consists of reddish, subacid, saccharine, slightly astringent, mucilaginous juice, contained in cells divided by membranes, and crowded with seeds. It is cooling and gently aperient. All the other parts of the Pomegranate plant are Astringent; and, as an exception to the other individuals of the natural order to which it belongs, the leaves of the Pomegranate contain no volatile oil, but much tannic acid. The bark of the fruit is called *Malecorium.* The petals are medicinally employed under the name of *Balaustines:* they are inodorous, acerb, and contain a large quantity of tannic acid: their action on the system is tonic and astringent. The bark of the root is now, also, officinal.

* Mr. Squire, Chemist to the Queen, Oxford-street, has lately introduced a tincture of the Red Rose, which is the best preparation of it, and is always ready for use.

† Woodville's Med. Bot. 3rd edit. p. 531, pl. 190. London Dispensatory, art. Punica. Richard, Hist. Nat. Med. t. ii, p. 408. Lindley, 74. Hayne, x, 35.

Balaustines afford a red, aqueous infusion, which the sulphates of iron blacken. The infusion, although not contained in any of the British Pharmacopœias, has been employed with great advantage as a gargle in relaxation of the uvula and inflammation of the fauces; and is internally administered in chronic diarrhœa. In the last-mentioned disease, Balaustines have been given in the form of powder, suspended in mucilage of quince seed; or the decoction, in conjunction with the same mucilage, may be exhibited as an enema. The bark of the fruit possesses the same astringent properties as the *Balaustines*, but in a higher degree; and communicates its properties to water. From the deep black-blue which its infusion strikes with the sulphates of iron, and the slight precipitate which it affords with gelatin, it evidently contains much tannic acid. According to the analysis of Mitouart, it contains both tannic and gallic acid, wax, and a saccharine substance, one part of which is soluble in alcohol and crystallizable, the other soluble in water. According to Davy, the components of the bark of the fruit are 18·8 of tannin, 17·1 of mucilage, 10·8 extractive, 30 lignin, 23·3 water, with a trace of resin, = 100·0. The decoction is precipitated by carbonate of potassa, but not by pure potassa; hence, if an alkali is requisite to be given with either pomegranate bark or balaustines, the pure alkalies must be employed. Lime water precipitates the decoction; and, owing to the tannic acid which it contains, it is also precipitated by sulphuric acid copiously, and hydrochloric slightly; but not by nitric acid.

The bark of the Pomegranate is an Astringent of great antiquity in chronic diarrhœa, and in the protracted stage of dysentery, when no inflammatory symptoms are present.

Decoction of Pomegranate Bark, *Decoctum Granati*, L. is made with ℥ii of Pomegranate rind and Oiss of distilled water, boiled down to Oi and strained. It is chiefly employed as a gargle in relaxation of the uvula and fauces. The best form of administering the Pomegranate Bark, internally, is in decoction. The dose is f℥iss to f℥ii.

Bark of the Root of Pomegranate. *Granati Radix*. E. D.—The root of this plant is covered with an ash-grey bark, speckled with green spots; it is easily separated and formed into imperfect quills, which are about half an inch to three fourths of an inch in breadth, and scarcely a line in thickness: internally yellowish; brittle, and exhaling a faint, peculiar odour. The recent root is bitter, but this property is lost in drying: when chewed, it tinges the saliva yellow. It yields its properties to water, forming an infusion which is precipitated yellowish-white by gelatin, greyish-yellow by bichloride of Mercury; and strikes a deep blue-black with salts of Iron, whilst pure potassa and ammonia give it a purple tint. According to Mitouart, this bark contains 22 of tannic acid, + 26 of starch, combined

with gum, lime, and tannic acid, + 2·5 of concrete oil, + 45·5 lignin, + 4 wax and mannite, = 100·0. Bonastre found volatile oil in the fresh root.

In Hindostan, where the Pomegranate was introduced from Persia, the bark of the root has been long medicinally employed as a remedy for the expulsion of tape worm; and, according to M. Deslandz, the negroes of St. Domingo use it for the same purpose. If the accounts that are given of it be correct, it is surprising that it has not been long since introduced into this country*. It has been lately admitted into the list of Materia Medica of the Edinburgh and the Dublin Colleges. It may be administered, in the form of powder, in doses of eight grains to a scruple, twice or thrice a day. In India, a decoction of it is made by boiling ℥ii of the bark in a pint and a half of water down to f℥ix, of which f℥ii are given every half-hour, until the worm is expelled, which generally occurs in twelve hours after the first quantity has been administered. It is the bark of the root of the wild Pomegranate which is generally employed; but M. Pichonnier asserts that the fresh root of the cultivated plant is equally efficacious†. The strong decoction appears to excite considerable nausea; but experience has proved that there is no necessity for making it so strong. In many instances, even in weak doses, it causes griping. It also acts on the nervous centres, producing vertigo, tremblings, and the sensation of intoxication, with weariness in the thighs and legs, and other symptoms indicative of a poisonous quality in the bark. Mr. Breton‡ mentions that he placed live tæniæ in the decoction of the bark of the Pomegranate root, and also in a mixture of the powder of the root in water, and observed that "the instant they (the tæniæ) were plunged in these preparations, they writhed, and otherwise manifested great pain, and died in the space of five minutes." That their death, in these cases, arose from the influence of the bark, is evident, as these worms live several hours after expulsion, when kept in plain tepid water. It is not, however, easy to say how much of this effect is due to the astringency of the bark. It possesses chemical properties different from those either of Balaustines or the Malecorium. If it is moistened with a little water and rubbed upon paper, it leaves a yellow trace, which passes to a deep blue when touched with sulphate of iron: these traces, moistened with an acid, acquire a rose tint, which soon disappears, leaving a dull brownish-yellow colour. If experience shall confirm the efficacy of this bark in tape worm, it will soon supersede the use of the volatile oil of turpentine; the intoxicating effects of which, when taken in the

* Celsus informs us that the ancients used it as a vermifuge.—De Medicina, lib. iv, § xvii.

† Chevallier asserts that the bark of the root of the cultivated plant is inert.

‡ Medico-Chirurg. Trans. vol. xi, p. 301.

dose necessary to expel tape worm, is a great objection to its employment.

k. The Sloe. *Pruni Spinosæ Fructus.*—This is one of the few fruits indigenous to our climate. The plant is a shrub, common in hedge rows, flowering in March and April. It is arranged in the natural order Amygdalaceæ*. The fruit is a drupe, about the size of a large pea, of a black colour, covered with bright blue bloom. It is inodorous, but has a sharp, austere taste. The juice, expressed and inspissated at a low heat, is a powerful Astringent.

As an Astringent, the Sloe was employed in the time of Dioscorides, and is still used as a domestic remedy, although it has been rejected from the Pharmacopœias. It has one advantage over many other substances in this class of remedies: it exerts no stimulant influence; and, therefore, may be administered even when inflammatory symptoms exist. It was formerly administered as a conserve; but the inspissated juice of the unripe fruit, or a tincture in proof spirit, is preferable. The inspissated hardened juice, prepared as above, may be given in powder, in doses of from eight grains to a scruple, three or four times a day.

* * * * * * * *Vegetable Secretions.*

l. Kino. L. E. D.—The Kino, originally introduced into the list of Materia Medica of the British Colleges, came from Africa; and, from a specimen sent home by Mungo Park, in 1815, it has been ascertained to be the juice of a species of Pterocarpus, which M. Pivet described in the Encyclopédie Methodique, under the specific name *Erinacea*†: a fact which was confirmed by Dr. Brown‡, who also found that the Pterocarpus *Senegalensis* of S. W. Hooker is identical with it. This assertion of Dr. Brown has been since verified by the authors of the Flora Senegambia (1830-33), who include also the Pterocarpus *Adansonii* of De Candolle, as a variety of the same plant. It is found near St. Mary's, on the Gambia. The London and the Edinburgh Colleges, overlooking the fact that scarcely any of this kind of Kino is now found in the market, has designated this plant, in their Pharmacopœia, as the source of Kino: but the Edinburgh College, in the last edition of its Pharmacopœia (1841), has also wisely put down Kino as the production of other undetermined genera and species. Much of what is found in the shops is the production of Eucalyptus *resinifera*, a plant found in Van Dieman's Land, belonging to the natural order Myrtaceæ: its juice

* Woodville's Med. Bot. 3rd edit. p. 518, pl. 186. Richard, Hist. Nat. Med. t. ii, p. 441. Lindley, Flora Danica, t. 926.

† London Dispensatory, art. Kino. Lindley, 256. Flora Senegamb. 54.

‡ Denham's Travels, Appendix.

resembles Kino in many respects, and even in the effect of reagents upon it. It exudes spontaneously from the tree, in the manner of some gums, and is inspissated in the sun. It differs from Kino in being less easily pulverized; and in adhering to the teeth when chewed; and in gelatinizing in the weak tincture.

The Dublin College formerly considered Kino as the production of the Butea *frondosa*, a native of the coast of Coromandel; but the red juice of this plant is certainly not Kino; and the Dublin College, convinced of this, has left the plant unnamed.

The Pterocarpus *erinacea* is a tree rising from 40 to 50 feet, and belongs to the natural order *Leguminosæ*. The pods are bristled. A pale red is extracted from natural cracks, as well as from artificial incisions in the trunk, and concretes into brittle black tears, which are Kino*. These tears crack and split, in drying, into irregular little masses, which are of deep garnet, nearly black, colour. These are inodorous, somewhat bitter, and intensely astringent. They adhere to the teeth when chewed, and tinge the saliva red. Its brittleness renders it easily pulverized; the powder losing its black colour and becoming of a dull red hue. It burns without flame, and leaves a grey ash. It is only partially soluble in cold water, with which it forms a deep red solution, and leaves a greyish residue. Boiling water dissolves nearly the whole, in the proportion of one part of Kino for every 25 of water. Rectified spirit dissolves two thirds only of it, forming a deep claret-coloured tincture. Proof spirit dissolves less than rectified. The aqueous solution is precipitated in the form of a dark-green pulpy mass by Sesquichloride of Iron; grey, by Acetate of Lead; and lake red, gelatinous, and muddy, by Potassio-tartrate of Antimony.

A portion of the Kino now found in commerce is the inspissated juice of the Nauclea *Gambir*, an Indian plant, belonging to the natural order Rubiaceæ†. This Kino is neither a gum nor a resin, but a dry extract, prepared from the leaves and the young twigs of this Nauclea, which are boiled in water for an hour and a half, and the decoction repeated with fresh quantities of water: these combined decoctions are next inspissated to the consistence of honey, then poured upon plates, and, when the solution is sufficiently solidified, the cake is divided into small portions, and the drying completed by exposure to the sun, taking care to turn the mass regularly and frequently. Another process consists in infusing the leaves and young twigs for some hours in water: the infusion, when inspissated, forms a feculent deposit, which is moulded into little cakes. These last are

* These tears are called *Kari* by the natives.—Gray's Travels.

† Linnæan Trans. vol. ix.

never found, as articles of commerce, in the European market; although some of the first preparation is brought home.

The *East India Kino*, the production of the Nauclea *Gambir*, is sometimes in irregular masses, dry and brittle, dividing readily into smaller pieces: sometimes it is in small brittle fragments, apparently the larger masses broken down, of a deep uniform claret-brown colour, shining and breaking with a vitreous fracture, exhibiting sometimes small cavities in the interior of the pieces. The colour and exterior aspect of this Kino varies in the different parts of India where it is made. Hunter says that that made in Sumatra and on the coast of Malabar is lighter coloured than that which is made elsewhere. It is easily pulverized, and affords a powder of a brown chocolate hue. When in the solid state, this species of Kino is inodorous; but, when dissolved in boiling water, it exhales a slight bituminous odour; when chewed, it scarcely colours the saliva, and has a slightly bitter, astringent taste. Alcohol dissolves a large portion of it*.

The *New Holland Kino* is procured by wounding the Eucalyptus *resinifera*, and allowing the exuding juice, which flows most abundantly, even to the amount of six gallons from one tree, to dry in the sun. It is bitterish and only slightly astringent to the taste, tinges the saliva dirty red when chewed, breaks with a glassy fracture, and affords a brown-coloured powder. Cold water acts very slowly and slightly upon it, the solution of what is taken up being of a pale yellowish-brown: boiling water forms a deep cherry-red solution, and throws down a brick-coloured precipitate on cooling. The solution, which is yellowish-brown, is coloured deep green by Sesquichloride of Iron; a greyish-yellow, with Acetate of Lead. Rectified Spirit dissolves a considerable portion of it, and forms a deep-yellowish-brown tincture†.

As scarcely any *Jamaica* or *Columbia* Kino can be procured, it is unnecessary to describe these varieties.

All the varieties of Kino have some properties in common. They all are more soluble in hot than in cold water; and, in cooling, the solutions let fall a precipitate, which agglutinates into masses that can be softened by heat. These residues of the aqueous solutions are insoluble in alcohol, and cannot be fused by heat. Alcohol dissolves nearly the whole of the *East Indian Kino*, forming a deep claret-coloured tincture, which is not resinous, and is not rendered turbid on the addition of water. It is also very soluble in ether; and the solution, when poured on water, leaves no pellicle on its surface. The *Botany Bay Kino* yields only two parts in three to alcohol, and forms a deep-brown

* Dr. Christison doubts whether Kino is the production of the Nauclea *gambir*. My opinion is based on the authority of Dr. Wallich and of Hunter.

† The greater part of this description of Botany Bay Kino is taken from Dr. Christison's Dispensatory, p. 578.

tincture. Ether dissolves about 1-20th, and forms a brownish straw-coloured solution, which leaves a thin resinous pellicle when it is evaporated in water. The solutions of all the Kinos are affected by the reagents which demonstrate the presence of tannic acid in other astringent vegetable solutions; but the results demonstrate that the acid exists in a particular state. Thus—*gelatin* throws down a precipitate of a rose colour; *per-sulphate of iron* strikes a deep green, and the precipitate is unalterable in the air; *bichloride of mercury* throws down a reddish precipitate. The alkalies merely deepen the colour; but copious precipitates are thrown down by their carbonates: all the *mineral acids* produce brown precipitates.

I might here mention the analysis of Vauquelin; but it was made with the Kino, not generally found in the shops, obtained from the Coccoloba *uvifera*, a tree belonging to the natural order *Polygonaceæ*, and growing in Jamaica. In chemical properties, however, all the varieties of Kino so far accord, that we may safely pronounce their constituents to be tannic acid, extractive, and a peculiar principle, which is insoluble either in water or alcohol. Boiling water is the best solvent of this Kino, dissolving nearly the whole; boiling rectified spirit dissolves three-fourths.

Kino is a valuable Astringent in all cases that require the aid of Astringents; although Dr. John Davy maintains that it possesses little power on the animal œconomy when given alone. It was introduced into medicine by Dr. Fothergill, on account of its astringent properties; it is employed in diarrhœas when they are kept up rather by general relaxation of the intestinal canal than by irritation of the mucous membrane. It is said to be less effective than catechu; but this is not in accordance with my experience; and I cannot readily perceive upon what ground it should not be at least an equally useful Astringent. Dr. Pemberton recommends it highly, in combination with opium, in Pyrosis. The opium of itself relieves the pain and spasmodic part of the attack; and the Kino, in giving tone, consequently allays irritability. Dr. Pemberton prefers it to other vegetable Astringents, "because," says he, "in this drug you have a medicine which exerts its power to restrain the discharge of the glands, when they are secreting too much, without exerting any such powers on the glands when they are acting naturally." Without criticising too closely the hypothetical nature of this explanation, there is no doubt of the efficacy of this application of Kino, and its use in dyspepsia. In prescribing Kino, it should be known that the alkalies destroy its astringency, and that it differs from some of the other vegetable Astringents in throwing down precipitates with bichloride of mercury, as well as with potassio-tartrate of antimony and potassa.

The local and external employment of Kino has been much

neglected in this country and in Europe. Its peculiar properties adapt it for many cases of local affections: for gargles in relaxation of the uvula, and as a dentifrice, in combination with charcoal, in a spongy state of the gums. The Malays apply it externally to cure burns and other abrations of the skin; and I can bear testimony to its utility, when employed as a styptic, to give tone and to diminish the ichorous discharge of flabby, ill-conditioned ulcers. In some respects, in these cases, the tannic acid operates nearly in the same manner as on dead animal matter, by coagulating the albumen and forming a kind of covering from the air; whilst, at the same time, its tonic influence on the living system tends to counteract that state which is always the attendant, if not the predisposing cause, of gangrene. Were Dr. Pemberton's view of the action of Kino correct—namely, that "it contracts a vessel too much relaxed, to its natural standard, but that it is unable to contract it any farther," it might be most advantageously employed in gleet. But the remark requires to be more narrowly examined before it can be implicitly acted upon. Kino may be administered either in substance, in solution, or in tincture.

COMPOUND POWDER OF KINO, *Pulvis Kino compositus*, L. D. is a compound of ʒxvi of powdered Kino, ʒiv of powdered Cinnamon, ʒi of hard Opium in fine powder. It is an unchemical mixture, as the tannic acid of the Kino decomposes the Opium, when the powder is mixed in water. The dose is from gr. x to ʒi.

TINCTURE OF KINO. *Tinctura Kino*. L. E. D.—Each of the Colleges has its peculiar formula. The London College orders ℥iiiss of bruised Kino to be macerated for fourteen days in Oii of Rectified Spirit, and strained: the Edinburgh, the same quantity of ingredients to be either macerated for seven days and then filtered, or prepared by percolation: the Dublin orders ℥iii of powdered Kino to be digested for seven days in three old wine pints of Proof Spirit, and then filtered. Much depends on the kind of Kino employed; with that now most common in the market, the Proof Spirit takes up a large quantity of jelly contained in the Kino; and after a time deposites it, dividing the Tincture into a solid and fluid portion. The dose of the Tincture is fʒi.

2. CATECHU. L. E. D.—This is a substance which was originally brought from Japan; and, being regarded as an earth, was called Terra Japonica. It is now imported from Bengal and Bombay, and is known to be an extract of the wood of the Acacia *Catechu*, a tree of the natural order *Leguminosæ**, the Uncaria *Gambir*, one of the order *Cinchonaceæ;* and the Areca

* Woodville's Med. Bot. 3rd edit. p. 433, pl. 157. London Dispensatory, art. Catechu. Richard, Hist. Nat. Med. t. ii, p. 537. Lindley, 268. Hayne, vii, 48. Roxb. Plant. Coromond. ii, p. 40, t. 175.

Catechu, a palm. It is also said to be the product of Butea *frondosa*, another of the Leguminosæ. Each of the Catechus procured from these plants has its own special character; but, generally speaking, Catechu is a solid, brownish, infusible substance, very astringent, and heavier than water.

The Acacia *Catechu* yields the largest proportion of the Catechu brought to England. It is manufactured chiefly in Canara and Behar. This Acacia is a shrub, rising about twelve feet, and called Khire, in India.

The whole of the tree yields Catechu; but in Behar it is prepared only from the chips of the interior, hard, brown, or heart wood. These are boiled in water; the decoction evaporated, and, finally, inspissated in the sun until it is brought to a considerable thickness, when the mass is spread out on a mat, previously covered with the ashes of cow's dung; and, being divided into square pieces by means of a string, these are generally hardened*. Dr. Royle informs us that the *Kutt* manufacturers (called Cutteuries†) in the north of India move to different parts in different seasons, and erect temporary huts in the jungles where they select the trees, and cut out the inner wood in chips, which they put into earthen pots, cover them with water, boil them, and strain the liquor. This is collected into one general receiver, in which it is boiled to a proper consistence, and then poured into clay moulds of a quadrangular form. This Catechu is of a pale-red colour, and is considered of the best quality. It is exported from Calcutta‡. The lump Catechu is prepared by a similar process.

The Uncaria *Gambir*, which also yields part of the Catechu brought home, is a climbing shrub, a native of Malacca, and various parts of eastern Asia: but it is cultivated for obtaining the Catechu, which is procured by evaporating a decoction of its leaves, and running the inspissated juice into square moulds. Two sorts are made;—one externally pale brown, but internally pale yellowish-brown; the other yellowish-brown within and without‖. The first is that imported into this country.

M. Guibourt has stated that another sort of Catechu is procured by boiling the nuts of the Butea *frondosa;* but this is very doubtful; and, certainly, none of it has found its way to this country.

It has been stated by Dr. Hayne, and is generally believed in Europe, that another species of Catechu is procured at Sirah,

* Mr. Kerr, who first gave the public correct information on the origin of the Catechu, says that the name is a compound of two Oriental words, *Cate*, which signifies a tree, and *Chu*, which signifies juice.—*Med. Obs. and Inquiries.*

† Mackintosh, Proceedings of Bombay Geographical Society, 1838.

‡ Illustration of the Botany, &c. of the Himaleyan Mountains, by J. F. Royle, M.D. &c. p. 182.

‖ Trans. Linn. Society, ix, 1807.

in Mysore, from the nut of the Areca Catechu; but Dr. Wallich has informed me that this is a mistake, and that all the other kinds are the productions of other species of Acacia*.

Catechu is imported into this country from Bengal, Bombay, Singapore, and Pegue. The varieties in the English market are distinguished as pale and dark. The first kind, pale Catechu, is generally in small square cakes, of a pale, reddish-brown colour; light and friable; breaking with an even, dull fracture; its taste is at first bitterish and astringent; but, after being chewed for a short time, it leaves a sweetness on the palate. This Catechu comes from Singapore, and is the production of the Uncaria *Gambir;* it is called in commerce *Black Gambeer.* Another Catechu, from the same source, is called *Pale Gambeer.* It is in small square cakes, about an inch in length, and weighing not more than two scruples: its colour is greyish-yellow throughout; its taste less astringent and sweeter than the former kind. It is not an article of English commerce. The second kind, or dark ball-Catechu, is generally in balls, or roundish masses, having an iron-rust colour externally, and a deeper colour within, often streaked or marbled. The masses are sometimes covered with rice-husks. It is less bitter than the pale kind, and leaves more sweetness on the palate. The colour is a deep chocolate, nearly black; the fracture is shining and resinous. Catechu is also distinguished by the name of the Presidency whence it is exported; as, for instance, Bengal and Bombay Catechu. The former is lighter than the latter, its sp. gr. being 1·28; and that of Bombay 1·39. Catechu softens in a moderate heat; and froths up and chars in a greater.

Sir Humphrey Davy examined its chemical properties, and found that very little difference exists between the varieties. 100 grains, macerated in 18 ounces of water, left $7\frac{3}{4}$ grains only undissolved; and these were impurities, consisting of carbonate of lime, aluminous earth, and sand. The solutions of Catechu vary in colour according to the variety from which they are made; all of them are inodorous, slightly redden the tincture of litmus, strike a deep green with sesquisalts of iron, but scarcely affect the proto-salts, and throw down copious precipitates with gelatin and concentrated sulphuric and hydrochloric acids, alum, nitrate of potassa, sulphate of magnesia, sulphate of copper, acetate of lead, tartar emetic, the vegetable alkaloids, infusions and decoctions of the substances yielding them, and several neutral salts. When the fine powder is washed until the water which comes off no longer precipitates gelatin, what remains is ex-

* In South America, a substance is procured from the Cinchona *excelsa,* which closely resembles Catechu. It is also well known that a species of tannic acid, termed *Bablah,* is prepared in Upper Egypt from the pods of the Acacia *Arabica.* Indeed, almost all the beautiful and extensive family of Acacia yield tannic acid.

tractive. It is of a pale reddish-brown colour, inodorous, and impressing a slightly astringent, sweetish taste on the palate. The aqueous solution of this extractive does not redden the tincture of litmus; hence the effect of the solution of the entire Catechu on this vegetable colour is due to the tannic acid: it renders the sesqui-salts of iron green, throwing down a precipitate, which becomes black on exposure to the air. From the effect of these reagents, it is evident that this is not pure extractive; but there is no reason for believing, with Dr. Bostock, that Catechu contains gallic acid. Alkalies and the carbonates destroy the astringent property of Catechu. According to the analysis of Sir Humphrey Davy, the constituents of Catechu are of

Tannin, (in Bombay Catechu,)	109; (in Bengal,)	97
Extractive	68	73
Mucilage	13	16
Impurities	10	14
	200	200

The only difference between the tannic acid of Catechu and that of Galls is the green precipitate which the former gives with salts of the sesquioxide of Iron. The extractive of Davy and that above mentioned is now considered an acid, and named Catechuic acid,—a compound, according to Wackenroder, of 20 eq. of carbon, + 10 Hydrogen, + 9 Oxygen, equiv. = 200·40*. The real quantity of Tannic acid in the different kinds of Catechu is yet undetermined.

The mucilage may be separated by digesting the Catechu in strong alcohol, which takes up the Catechuic and the Tannic acid, and leaves the mucilage. Alcohol, pure or diluted, is a better solvent of Catechu than water. The alcoholic solution is not precipitated by water. Ether takes up only the Tannic acid.

As an Astringent, Catechu is one of the most valuable for internal administration. The dark-coloured or ball-Catechu is the best for medicinal use: it is proper in all cases in which the employment of Astringents is indicated. As a local remedy, it is almost specific in those relaxations of the uvula which, from the irritation excited by the lengthened organ irritating the glottis, are attended with a teasing cough. This has not only been mistaken for phthisis, and treated accordingly, but, from the continued irritation kept up by it in habits predisposed to tubercular deposites, it has been the exciting cause of that intractable and hitherto fatal disease. In the hoarseness of relaxation to which almost all the public singers are liable, nothing is

* Catechuic acid is procured by exhausting the Black Gambeer with cold water, then acting on the residue with hot alcohol, distilling off one half the spirit, filtering, and evaporating the tincture to one half, at 100° Faht., and, lastly, setting it aside to crystallize.

more useful than Catechu: but it is scarcely necessary to say, that, in all cases attended with inflammatory symptoms, it ought not to be prescribed. Its tonic powers are considerable; and in dyspepsia, attended with relaxed bowels, I know of no better remedy.

Catechu may be administered in the form of powder, infusion, or rather solution, tincture, and electuary. The dose of the powder is gr. x to ℈i. Two infusions are ordered—a simple and a compound.

Infusion of Catechu, *Infusum Catechu*, E. is made by infusing ʒvi of powdered Catechu and ʒi of powdered Cinnamon in f℥xvii of boiling water for two hours, then straining through linen or calico, and adding f℥iii of syrup.

Compound Infusion of Catechu, *Infusum Catechu compositum*, L. D. is made by infusing ʒvi (ʒiiss, D.) of powdered Catechu, ʒi (ʒss, D.) of bruised Cinnamon, in Oi (half a pound, D.) of boiling distilled water, for an hour, in a covered vessel, and straining. Both infusions are sometimes combined with opium; but, when Catechu is to be given in combination with chalk mixture, or with opium, the infusion is a bad form of preparation, and the powder should be used. This is particularly to be attended to in prescribing Tincture of Opium, Tincture of Cinchona, or any of the alkaloids, as with Catechu an insoluble tannate is thrown down. Emetina is precipitated when ipecacuanha is prescribed in aqueous solutions of Catechu; and as the emetina is the active principle of the ipecacuanha, and is thrown down as an inert tannate, they should never be prescribed together. The compound infusion of Catechu is made with cinnamon bark; but the oil as an oleosaccharum would be a preferable addition. The dose is f℥i to iii.

Tincture of Catechu. *Tinctura Catechu.* L. E. D.—The London College orders ℥iiiss (℥iii, D.) of Catechu and ℥iiss (℥ii, D.) of bruised Cinnamon to be macerated for seven days in Oii (one old wine pint, D.) of Proof Spirit, and strained. The Edinburgh College orders ℥iiiss of powdered Catechu and ℥iiss of powdered Cinnamon to be either digested for seven days in Oii of Proof Spirit, then pressed and filtered; or the Spirit to be passed through, the powders previously moistened with a little of the spirit, in the percolater.

Electuary of Catechu, *Electuarium Catechu*, E. *Electuarium Catechu compositum*, D. is made with ℥iv of Catechu, ℥iv (℥iii, D.) of Kino, ℥i (℥ii, D.) of Cinnamon, ℥i of Nutmeg (none, D.), ʒiss of Opium diffused in a little Sherry, and Oiss (two pounds and a quarter, D.) of Syrup of Ginger reduced to the consistence of Honey. The materials, reduced to powder, are to be mixed with the Opium, and made into an Electuary with the Syrup. This is a useful combination of Astringents and

Aromatics: the Opium might be omitted. The dose is ℈i to ʒi.

The Tincture, being free from mucilage, is more astringent than the Infusion, and should be preferred to it when the nature of the case does not forbid the use of spirit.

Logwood, *Hæmatoxylon,* E. *Hæmatoxylon,* L. D. is the inner wood of Hæmatoxylon* *Campechianum,* a tree rising with a crooked stem, 40 to 50 feet high, and about eight inches in diameter, a native of South America, growing abundantly in the Bay of Campeachy, whence it derives its specific name. It belongs to the natural order Leguminosæ†. The wood, which is of a dull cherry-red colour, is imported into this country chiefly as a dye stuff. It is hard, and susceptible of a fine polish; is inodorous, and impresses a sweet taste on the palate.

The astringent and the colouring principles of Logwood are given out both to water and alcohol. The aqueous decoction is of a deep red-purple colour: it exhibits some singular effects on reagents, which are partly owing to the tannic acid and extractive it contains, partly to the Hæmatine, or Hæmotoxylin, the colouring principle of the wood, discovered by Chevreul‡.

Decoction of Logwood, *Decoctum Hæmatoxyli,* E. D. is made with ℥i (℥iss, D.) of the chips, ʒi of powdered Cinnamon, boiled in Oi (two old wine pints, D.) of water to f℥x (a pint, D.), and straining. The dose is f℥ii to f℥iv. Persulphate of iron strikes a deep bluish-black, and slowly forms a precipitate of the same colour with the decoction; sulphate of copper throws down a copious brownish-black precipitate; acetate of lead, a reddish-black; the mineral acids produce slight reddish-brown precipitates; the alkalies merely deepen the colour of the decoction; alum throws down a copious purple precipitate; lime water a deep purple.

Extract of Logwood, *Extractum Hæmatoxyli,* L. E. D. is prepared by macerating lbiiss (lbi, E.) of chips of Logwood, in conj. ii (conj. i, E.) of boiling water for twenty-four hours; then boiling down to conj. i (Oiv, E.) straining, and concentrating to a proper consistence. The dose is gr. x to ℈i.

The aqueous solution of the extract forms precipitates with the solution of potassio, tartrate of antimony, and of sulphate of magnesia; hence both these and the reagents which form preci-

* The genus Hæmatoxylon derives its name from the colour of the wood of this its only species, from two Greek words αιμα and ξυλον, of which it is compounded, signifying *blood tree.*

† Woodville's Med. Bot. 3rd edition, p. 455, pl. 163. London Dispensatory, art. Hæmatoxylon. Richard, Hist Nat. Med. t. ii, p. 529. Lindley, 264. Hayne, x, 44.

‡ Ann. de Chimie, lxxxi. Hæmatoxylin is procured by acting on an extract of the wood, prepared with tepid water, by rectified spirit, distilling it off until a syrup fluid remains, and then adding a little water. It crystallizes in scarlet coloured crystals, slightly soluble in water, more soluble in alcohol and ether.

pitates with the decoction are incompatible in prescriptions with it and the extract.

Logwood, as an Astringent, is mild in its action. It has been found useful in chronic diarrhœa, and in giving tone to the system in convalescence from dysentery. In the cholera of infants, the infusion is beneficially administered, in doses of a table-spoonful every third hour. Like some other vegetable infusions, containing colouring matters in combination with extractive, it passes through the kidneys, and may be detected by alkalies in the urine. It is almost unnecessary to say that, in prescribing Logwood as an Astringent, the Decoction and the Extract ought not to be united with chalk mixture, nor with lime water.

* * INORGANIC PRODUCTS OPERATING AS TONIC ASTRINGENTS.

These are chiefly acids and metallic salts.

Acids.

1. Diluted Sulphuric Acid. *Acidum Sulphuricum dilutum.* L. E. D.—For medicinal purposes, as an Astringent, this acid requires to be largely diluted. In the proportions ordered by the London College, there is one part of the strong acid to five and one-fourth of water; in the Edinburgh, nearly one to seven; and the same are the proportions in the Dublin: but these proportions must vary according to the specific gravity of the acid employed—a fact which is too little attended to in making the diluted acid. The sp. gr. of the strong acid of the London Pharmacopœia should be 1·845; that of the Edinburgh is 1·090; and when it is weaker, it should be boiled in a flask, to dissipate the water and to bring it to the above strength, before the diluted acid be made.

The strong acid always contains a small quantity of sulphate of lead and of potassa; and also some nitrous acid; sometimes sulphate of potassa is added to weak acid to increase its specific gravity. As a medicinal agent, the acid is not injured by the small quantity of sulphate of potassa and nitrous acid which it obtains in the preparation of the acid; and the salt of lead is easily removed; for as the acid cannot be administered in an undiluted state, the sulphate of lead is never retained in the diluted acid. Indeed, the best mode of purifying sulphuric acid from the salt of lead is to dilute it, and then to distil off the water from the decanted diluted acid. It should always be permitted to cool before the diluted acid be decanted from the precipitate.

The diluted acid is administered, in doses of from m. vi. to m. xxx, or more, in f℥iss of water, or infusion of roses, or infu-

sion of confection of roses, or in the same quantity of mucilage of acacia gum, or in any bitter infusion, to operate as an Astringent. In some cases—as, for example, malignant erysipelas with a tendency to hæmorrhage and Ecthyma *Curidum*—it may be carried to any dose that the patient can bear. I have given it to the extent of f℥ss, in the space of twenty-four hours, in uterine hæmorrhage. Its action as an Astringent is not easily understood without referring to its operation as a local stimulant: when diluted sulphuric acid is locally applied to any part of the body, it contracts and condenses the living fibre; and it is in part by this action, exerted on the circular fibres of the blood vessels into which it enters, that it operates in checking passive hæmorrhages: at the same time we must allow that its tonic influence on the stomach is extended to the whole habit; but this alone would be scarcely adequate to produce its astringent effect. There is no foundation for the opinion of Boerhaave, that this diluted acid coagulates the fluids when taken into the system. It is prescribed in both active and passive hæmorrhages. In the former, it is supposed to act chiefly as a refrigerant; by lessening febrile excitement, allaying thirst, and diminishing vascular action: in the latter, by its tonic and astringent power. In some individuals it causes violent gripings and purging; which, however, may be moderated by the addition of aromatics and of opium. In using opium, it must be recollected that this acid, by uniting with the morphia, renders the opium more powerful as an anodyne. As a gargle, in combination with infusion of roses, it is useful in relaxation of the uvula and fauces. As it is injurious to the teeth, it should be sucked through a quill, when given in large doses.

It might be supposed that it could not, with propriety, be combined with some vegetable Astringents; for instance, Kino and Catechu; but, in the degree of dilution in which it is employed as a medicinal agent, there is no objection to such combinations.

2. Acetic Acid. *Acidum Aceticum.* L. E. D.—This Acid, in its pure and highly concentrated state, is colourless, limpid as water, highly volatile, exhaling an extremely pungent, agreeable odour, rising in vapour at 260° Faht., and so acrid that it cannot be tasted: when applied to the skin, it inflames and blisters the part. When it is much concentrated, it takes fire at a high temperature in the open air. The sp. gr. of the most concentrated that can be procured is 1·063 to 1·077; but it is rarely obtained of a greater strength than that which indicates a sp. gr. 1·043, indicating about 33 per cent. of anhydrous acid. It crystallizes when cooled down to a temperature of 28° Faht., and remains solid until the temperature rise to 50°; but it melts again and remains fluid at 40° Faht., unless a crystal of the

acid be thrown into the fluid, when crystals instantly dart out from it on all sides, and the whole assumes the solid form. It crystallizes beautifully under a compression of 1100 atmospheres. The composition of the anhydrous acid, which exists only in dry acetates, is 3 eq. of Hydrogen = 3, + 4 of Carbon = 24·48, + 3 Oxygen = 24. Equiv. 51·48. ($C._4 H._3 O._3 = A.$)

Anhydrous Acetic Acid can only be procured from the dry acetates, or by means of charcoal, or exposing the vapour of alcohol to the action of air and spongy platinum. Each of the British Colleges has its peculiar process. The London orders lb. ii of Acetate of Soda, ℥ix of Sulphuric Acid, and f℥ix of water, to be distilled from a sand-bath, carefully regulating the heat towards the end. The Edinburgh orders Acetate of Lead to be heated in a porcelain basin to 320° Faht., and stirred until the fluid mass concretes again. When cold, this is to be pulverized and again heated to 320°, with frequent stirring till the particles cease to accrete. To ℥vi of this powder, f℥ixss of pure Sulphuric Acid are to be added in a glass mattrass; and having attached a proper tube and refrigeratory, it is to be distilled in a fusible metal bath at 320° to complete dryness. The distilled liquid is to be agitated with a few grains of red Oxide of Lead, afterwards allowed to rest for a few minutes, decanted off and re-distilled. The density is from 1063 to 1068·5. The Dublin College orders 100 parts of Acetate of Potassa and 52 of Sulphuric Acid to be distilled to dryness. The density is 1074. When the Acid is to be obtained by means of charcoal, according to the process invented by Lowitz, the charcoal must be put into a crucible, and, a cover being fitted, it should be brought to a red heat; and, when cold, mixed with common vinegar to the consistence of a paste, and distilled by a gradually raised fire. At first, an acidulated water comes over, which must be rejected; after which, the joints of the apparatus being well luted and the heat increased, the acid distils over in a concentrated, crystalline form. But the best method of obtaining the strong acid is to distil together ten parts of anhydrous Acetate of Soda, five parts of coarsely powdered Sulphate of Soda, and twenty parts of concentrated Sulphuric Acid*.

Acetic Acid, under the name of Pyrolygneous Acid, *Acidum Pyrolygneum*, E. is also produced from the distillation of wood†. An impure, dark-coloured acid, containing tar and an empyreumatic oil, is first obtained: this is mixed with lime, which takes up the Acetic Acid and leaves the tar and oil; an acetate of soda is formed by decomposing this acetate of lime with sulphate of soda, and is purified by fusion in a temperature insufficient to

* Dufflos.

† Pyroligenous acid, mixed with water, in the proportion of two fluid ounces to four of the water, is nearly the same as distilled vinegar of 1009 specific gravity.

decompose the salt. The acetate of soda is lastly decomposed by sulphuric acid, which sets free the Acetic Acid.

Strong Acetic Acid oxidizes iron, zinc, copper, nickel, and tin. It readily combines with all the metallic oxides and the alkaloids, forming acetates. It dissolves resins and gum resins, camphor, and volatile oils. During its union with water, heat is evolved.

In its concentrated state, Acetic Acid, taken internally, acts as a virulent poison; the best antidote is magnesia. The after-treatment should be the same as that for inflammation of the stomach.

Acetic Acid must be diluted with water, in the proportion of five parts of the acid and ninety-five of water, to render it useful as an astringent for medicinal purposes. It is usually procured by the distillation of common vinegar. The best vinegar is made from wine not more than a year old. At Orleans, where much of it is made, the wine is kept for some time in casks with beech shavings, which clarifies it; after which it is boiled, and poured into casks, in quantity sufficient to fill one third of each cask, and left for eight days; and afterwards two gallons and a half of wine are added, every eighth day, until the casks are two thirds filled. Eight days after this time, the vinegar is fit for use; but a portion only is drawn off, and fresh wine is added to keep up the contents of each barrel to two thirds of its capacity. The casks are exposed to the atmospheric temperature in summer; and in winter to a temperature of 75° Faht. maintained by means of stoves. In Holland and some other parts, the acetous fermentation of the wine is aided by having two double-bottomed barrels, one of which is kept only half full, the other always full. On the inner bottom of each, which is pierced with holes, the leaves of the vine and the footstalks of grapes are spread; and every twenty-four hours the half-full barrel is filled from the full one, so as to keep one of these barrels always full and the other half full. The fermentation proceeds most briskly in the half-filled barrel, and in fifteen days the vinegar is ready for use. In this country, vinegar is made from malt; but sugar and water, or any vegetable matter containing a saccharine principle, is sufficient. It is inferior to the French vinegar, and, as sold in the shops, contains a little sulphuric acid; an addition permitted, by the excise laws, to the extent of one part in 1000 parts.

The theory of the acetous fermentation is not so well understood as that of the vinous fermentation. When wine or any alcoholic fluid is employed, no acetous fermentation takes place unless the liquor be exposed to the air and to a temperature between 65° and 80° Faht.: it is very evident that the affinities between the constituents of the alcohol and the other ingredients are broken, and new combinations formed; whilst carbon, combining with the oxygen of the air, is disengaged in the form of

carbonic acid gas, although not in great quantity. When the process is conducted in close vessels, the quantity of carbonic acid formed exactly compensates that of the oxygen which has disappeared. According to Leibig, aldeheyd is formed by the combination of two equivalents of Hydrogen; and, by the subsequent absorption of two additional equivalents of Oxygen, one equivalent of Acetic Acid and one of water are formed. All the malic acid originally contained in the wine, as well as the alcohol, disappears, and the glutinous matter undergoes some change. The chemical difference between alcohol and vinegar consists in the greater relative proportions of the oxygen to the carbon, and the smaller proportion of hydrogen in the vinegar than in the alcohol. Alcohol consists of $C.^4$ $H.^6$ $O.^2$—by the change, which is the result of the fermentation, 3 eq. of water, + 1 of Acetic Acid ($C.^4$ $H.^3$ $O.^3$) are formed. The quantity of vinegar obtained is precisely proportional to the quantity of alcohol in the wine employed. Difficulties have been supposed to arise from the fact, that Acetic Acid is produced without the vinous fermentation having previously existed, as in making starch, and when gluten of wheat is fermented with sugar and water. Acetic Acid is also extricated when sulphuric acid is poured on some vegetable bodies.

Vinegar procured from wine or from malt is a fluid of an agreeable, penetrating odour, and a pleasant acid taste, varying in colour from a pale straw-yellow to a deep brownish red. It generally contains, besides Acetic Acid, a little undecomposed alcohol, mucilage, colouring matter, some sulphuric acid, which is added to it by the manufacturers, and water. In this state, vinegar is used as a condiment; but it requires to be distilled for the purposes of medicine. By the process ordered in the London and Edinburgh Pharmacopœias, seven-tenths only are ordered to be distilled. The first tenth is rejected by the Dublin College. What remains in the retort contains much Acetic Acid, saturated with carbonaceous matters, and so much bitartrate of potassa as to render it unfit for use.

Distilled vinegar has a less agreeable odour than common vinegar: the taste is also less pungent. It is limpid and colourless like water; but often contains some mucilage and extractive; independent of which, it is merely Acetic Acid largely diluted with water. At a sp. gr. of 1·007, distilled vinegar contains of Acetic Acid 3·42, + water 96·58 in 100 parts; and should dissolve 13·8 grains of white marble. It is often adulterated. Nitrate of silver detects hydrochloric acid by affording a precipitate insoluble in any acid. If it contain copper, ammonia or the ferro-cyanate of potassa detects it. Solution of perchloride of gold discovers tin, by forming the purple precipitate of Cassius; and sulphuretted hydrogen the presence of lead, by the deep brown precipitate which it throws down. On account of

these impurities, vinegar should always be distilled in a glass retort.

As a remedial agent, diluted Acetic Acid is a useful and agreeable Astringent; and produces a tonic effect, whilst at the same time it is refrigerant: it is a valuable adjunct to acetate of lead in phthisis, when hæmorrhage occurs. This acid, largely diluted, was employed as a refrigerant in phthisis so early as the time of Galen, and it is still employed for the same purpose by the Oriental physicians. But it has been lately used, in its less diluted state, and in larger quantity, to obtain its astringent influence. M. Orban, who witnessed its use at Tunis, says that the quantity taken daily was seven fluid ounces diluted with forty-nine fluid ounces of rain-water; pills consisting of small doses of alum and sulphate of iron being taken at the same time. The Moorish physician gave no favourable opinion of the effects of the acid, until it produced a costive state of the bowels, when he spoke with confidence of a cure being effected. This fact is too little attended to in the treatment of phthisis: the disease appears arrested when the bowels are confined; the cough becomes less irritable, and the strength of the patient is maintained. M. Orban left the patient he saw treated with it convalescent. He employed the same plan with considerable success in France. The only British practitioner who has recorded the result of his experience of the use of Acetic Acid in phthisis is Dr. Roberts, in whose hands the success of the practice was considerable*. It operates by restraining hæmoptysis, checking the hectic and morning sweats, and producing costiveness. Indeed, when we consider the nature of the disease, the debility that attends it, and its connection with the scrofulous diathesis, there is little doubt that the acid operates as a tonic astringent. It exerts also a powerful action on the absorbents; as the use of vinegar by young females, who wish to reduce themselves from a state of corpulency, has too frequently demonstrated. None of the cases in which I have employed it recovered; but all of them seemed to be benefited by its use. It diminishes action, checks night sweats, and restrains hæmoptysis and diarrhœa. It may be administered in conjunction with infusion of calumba or of cascarilla. The external use of this acid has not been confined to phthisis; it has of late been much employed in ordinary cases of debility, diluted in the proportion of one part of strong vinegar and five of water, for sponging the trunk of the body before the patient gets out of bed in the morning. In these cases its beneficial effects depend on its stimulant and astringent powers.

As an Astringent, vinegar has been administered internally, in combination with salt, in dysentery: it not only checks the

* Med. Trans. of the College of Physicians, vol. v.

purging, but corrects the fœtor of the stools. As a local Astringent, it has long been employed in relaxations of the uvula and fauces in the form of gargles, especially in those cases of ulceration attended with sloughing of the tonsils, such as occur in scarlatina and malignant or putrid sore throat. In such cases, however, it is not so frequently employed now as formerly, the aqueous solution of chlorine having been found more useful.

In the form of collyria, vinegar has been long and successfully used as a gentle Astringent in ophthalmic inflammation, and as a lotion in fœtid ulcers. As a local application, it has also been found useful in hæmorrhages. This effect, however, must not be confounded with that caused by the application of vinegar and water to the abdomen and thighs in uterine hæmorrhages, in which the acid acts as a refrigerant, simply by aiding the evaporation of the water.

Gallic Acid is a crystallizable acid, in silky prisms. It was first obtained by Scheele from gall-nuts: he published his method of procuring it in 1786. M. Pelouze supposes that it does not exist ready formed in galls, but is the result of a change in the Tannic Acid. Its taste is slightly acid, sweetish, and astringent. It is inodorous at the ordinary temperature of the atmosphere, and has an unpleasant, peculiar odour when heated. It is soluble in 100 parts of water at 60°. Alcohol dissolves one-fourth of its weight; ether also dissolves it. The crystals, when exposed to a moderate heat, lose 9·45 per cent. of weight, and effloresce. Its aqueous solution undergoes rapid decomposition when heated, and also spontaneous decomposition, becoming mouldy, when it is weak and exposed to the air. Its concentrated solution will remain unchanged; but if the smallest quantity of free alkali be present, oxygen is attracted, and it changes into a brown substance, with the evolution of carbonic acid. It sublimes by heat; and is converted into *pyrogallic* acid; leaving a black acid matter behind, which M. Pelouze calls *Meta-gallic* acid. *Pyro-gallic* acid is whiter than gallic acid, has a slightly bitter taste, and is soluble in 1½ parts of water at 56° Faht. and in ether. The aqueous solution reduces the persulphate of iron to the protosulphate, and nitrate of silver and of mercury to the metallic state.

Gallic acid forms soluble gallates with the alkalies. With barytic water and lime water it forms bluish-red flaky precipitates. It strikes a blue-black with all the salts of iron.

It is composed, according to the analysis of Berzelius, of—
Hydrogen 5·00, + Carbon 56·64, + Oxygen 38·36, = 100·00, or 3 eq. of Hydrogen = 3, + 7 Carbon = 42·84, + 5 Oxygen = 40, equiv. = 85·84.

Ruspini's Styptic, one of those medicines termed Patent, the

preparation of which is kept secret, owes its powers to gallic acid. Whilst we may declaim against the principle which has withheld the formula from the public, we cannot deny the value of this preparation as a powerful astringent. I have often witnessed its influence both as a local and an internal or general astringent. This styptic consists of gallic acid, a small proportion of sulphate of zinc and of opium, dissolved in a mixture of alcohol and rose water. In proof of this, the same reagents which affect Ruspini's Styptic, affect, nearly in the same manner, a simple solution of gallic acid in weak alcohol. It yields a bluish grey precipitate with lime water, which is redissolved by an excess of the lime water, and acquires a reddish hue: and it strikes a beautiful deep blue with the mixed sulphates of iron. As the quantity of sulphate of zinc and of opium is too small to influence the medicine, a simple solution of gallic acid in diluted alcohol will answer all the purposes of this celebrated and expensive styptic.

d. Metallic Salts.

1. ALUM. *Alumen.* L. E. SULPHATE OF POTASSA AND ALUMINA. *Sulphas Potassæ et Aluminæ.* D.—Alum is a salt, which was known to the ancients as a mordaunt in dying; but its nature was not understood till 1754, when Marcgraff detected a peculiar earth as one of its essential constituents. He named this earth *Argil;* but Morveau afterwards gave it the name which it now bears, *Alumina:* it is an oxide of a metal named Aluminium.

Alum is found ready prepared by the hand of Nature, in some places, as at Gotturg, in Austria, and at the Solfotara, near Naples; but the greater part of the Alum of commerce is prepared from aluminous pyrites or schistus, which is roasted and exposed to the action of the air and the moisture of the atmosphere: the sulphuret of iron present in the schistus is oxidized by attracting the oxygen of the air and that of the decomposed moisture; its sulphur, being thus converted into sulphuric acid, combines with the Alumina, and forms an efflorescence on the slate, which is separated by lixiviation, and the solution concentrated, until it acquire the sp. gr. 1·35, when some salt containing potassa is added: by which, on repeated crystallization, the salt of iron is separated from the Alum. This addition, however, is not always necessary, as the schistus sometimes contains potassa. The solution, being boiled and run into coolers, crystallizes; but it undergoes a second crystallization after running off the mother water of the first; and as this takes place in casks, in which the salt forms into a solid mass, the operation is termed *roching*, and the Alum thus crystallized is named Roch Alum.

The interior of the mass is generally in large regular octohedrons*.

There are various kinds of Alum: the Roman, which is very pure, is in irregular masses, covered with pink powder on the surface; the Levant, which is in small pieces also, of a pinkish or pale rose colour; and the English, which is in large masses. Alum, generally, slightly effloresces in the air; in a moderate heat it fuses, loses its water of crystallization, becomes opaque, and acquires a corrosive property when applied to the body: it is then termed *burnt* or *calcined Alum*. All the varieties are soluble in fifteen parts of water at 60°, and their own weight of boiling water. The solution generally reddens vegetable blues; and is decomposed by the alkalies, their carbonates, and the soluble earths, which precipitate the pure alumina. If the Alum contain iron, it is detected by first adding a little nitric acid to the heated solution, and then precipitating by ammonia, which renders the peroxide visible, of a yellowish-green, changing to a red colour. Alum is precipitated also from its solution by many infusions which contain extractive and tannic acid, by all the salts containing bases which unite with sulphuric acid—for instance, lime and magnesia, the carbonates of the alkalies, ammonia, and the hydrochlorate of ammonia, tartrate of potassa, the acetate of lead, and the greater number of the metallic salts; all of which are, consequently, incompatible in prescriptions with Alum. But it may be combined with the bichloride of mercury, and all the metallic sulphates. According to Berzelius†, Alum consists of 4 eq. sulph. ac. = 160·4, + 1 alumina = 250·4, + 1 pot. = 47·15, + 24 water = 216, equiv. = 434·95.

As a remedial agent, Alum is employed in cases requiring the use of Astringents, both generally and locally. When taken into the stomach, it causes, often, a disagreeable and painful sensation at the epigastrium; and, if the dose be large, nausea, vomiting, colic, and purging; but in small doses, constipation. When taken into the circulation, it is said to irritate the lungs and provoke coughing‡; but my experience has not confirmed this remark. It is employed, generally, in internal hæmorrhages; in chronic diarrhœa; in leucorrhœa; and in diabetes. It must, however, be recollected, that in old diarrhœas, when ulcerations

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* There are several Alum mines in Great Britain: one at Hurlett, near Paisley, where the aluminous slate lies above coal; and another at Whithy, where it is disposed in strata, nearly upwards of one hundred feet in depth and twenty-nine miles in breadth. On an average, one hundred and fifty tons of slate produce one ton of Alum.

The calcined slate is washed with four successive waters, and, when it acquires a sp. gr. of 1·45, kelp ley of a sp. gr. 1·025, is added to it: but the best Alum is made by the addition of soap-boiler's ley, which contains a chloride of iron, that does not crystallize with Alum.

† Alumina is a compound of 53·29 of Aluminum + 46·71 of Oxygen = 100·00.

‡ Traité Elémentaire de Mat. Med. par J. B. C. Barbier, 3rd edit. t. i, p. 521.

of the mucous membrane exists, Alum may be productive of mischief. In confluent smallpox, when the pustules are livid and filled with a bloody serum, Alum whey, prepared by boiling ʒii of Alum in a pint of milk, has been administered with much benefit.

Although Alum cannot be combined with the infusions and decoctions of astringent vegetables, yet it may be combined with opium and aromatics, which correct its tendency to disturb the bowels—a circumstance that sometimes proves detrimental in cases of uterine hæmorrhage, in which it generally operates beneficially. It was first given in this disease by Van Helmont; and the opinion of Cullen, in its favour, added considerable weight to Helmont's recommendation. In pyrosis, Alum has been recommended as an adjunct to opium; but I am of opinion that a sedative, rather than an Astringent, is required in this painful affection; and that the benefit in this case is due to the opium. As a local Astringent, it is useful in relaxations of the uvula, and in aphthæ; and no injection proves more beneficial than its aqueous solution in leucorrhœa and gleet. In chronic inflammation of the eye, it forms a good collyrium; and, in this case, the facility of uniting it with Sulphate of Zinc is a great advantage. In ecchymosis of the eye, the cause of which is not always obvious, the following is a very useful mode of applying it.

Coagulum, *Cataplasma Aluminis,* D. made by agitating ʒi of Alum in white of two eggs: the acid coagulates the albumen, whilst the serous or watery part dissolves a certain portion of the Alum; and an excellent vehicle is thus formed for its application. Alum is administered in the form of powder and solution.

The dose of powdered Alum for internal use is from gr. x to ʒss.

Compound Powder of Alum, *Pulvis Aluminis compositus,* E. consists of four parts of Alum and one part of Kino, mixed and reduced to fine powder. It possesses no advantage over the simple powder. The dose is gr. xii to ℈ii.

Compound Solution of Alum, *Liquor Aluminis compositus,* L. is a solution of ʒi of Alum and ℥i of Sulphate of Zinc in Oiii of boiling water, filtered. It is chiefly used as an external application.

The simple solution, both for internal use and external application, in point of strength, must depend on circumstances.

Burnt or Dried Alum, *Alumen exsiccatum,* L. E. *Alumen siccatum,* D. is prepared by fusing any quantity of Alum in an iron or an earthen pot, until all the water is driven off, and reducing the mass to powder. It is employed solely as an Astringent erodent.

Although an Astringent, Alum has been justly vaunted as a remedy in colica pictonum. In this case, much of the benefit

produced, if the remedy be early administered, is due to its chemical influence in converting the carbonate of lead, which has produced the mischief, into the sulphate, which is innocuous. Its further influence, as a stimulating Astringent, may prove useful in counteracting the paralysis of the intestinal nerves, and mitigating the pain. Dr. Percival recommended fifteen grains to be given every third, fourth, or fifth hour; and, as far as his experience went, he affirms that its use was followed with unvarying success.

2. SULPHATE OF IRON. *Sulphas Ferri.* L. E. D.—(p. 598.) TINCTURE OF SESQUICHLORIDE OF IRON. *Tinctura Ferri Sesquichloridi.* L. *Ferri Muriatis Tinctura.* E. *Muriatis Ferri Liquor.* D. (p. 593.) The styptic nature of the Salts of Iron is well demonstrated by their external application: but it is only in states of great debility, and in hæmorrhages occurring in scurvy and purpura, that they can with propriety be internally administered; so that they are seldom employed as general Astringents. When it is essential to order them, the dose, at first, should be small and gradually augmented. They enter the circulation slowly; but, after some time, excite a febrile action in the whole system, cephalalgia, with weight in the head, and tingling in the skin. As a local application, the tincture of the Sesquichloride is frequently used for touching cancerous and fungoid ulcers.

3. SULPHATE OF COPPER. *Cupri Sulphas,* L. E. D. (p. 583.) The astringent influence of this salt cannot be questioned: but, at all times, the salts of copper are hazardous when introduced into the stomach; and, therefore, I am not anxious to recommend this sulphate to notice, unless all other means fail. If it be given, and headache, vomiting, and pains of the bowels, with cramps in the legs, supervene, its use should be instantly discontinued, and a solution of the albumen ovi should be freely exhibited, giving at the same time from m. x to xv of the ferro-cyanate of potassa in water. It has been administered with great advantage in obstinate chronic diarrhœa, and in Asiatic cholera, in doses of from one-sixth to half a grain, combined with opium. I can say little of its value in these complaints from my own experience, having seldom prescribed it: but it undoubtedly has proved useful, and verified the accounts of its powers which Dr. Elliotson has published.

As an external Astringent, Sulphate of Copper is less exceptionable; for although it has proved fatal when applied to wounds in dogs and some other quadrupeds, yet it is applied to ulcers in the human body with impunity, except in peculiar idiosyncracies. In the proportion of gr. i in ℥i of rose water, it is an excellent injection in incipient gonorrhœa, producing a new and more healthy action in the inflamed membrane. It

should be employed on the first appearance of the symptoms, and continued twice a day, for a short time, after they have disappeared.

4. SULPHATE OF ZINC. *Zinci Sulphas*, L. E. D. (p. 582.) ACETATE OF ZINC, *Zinci Acetas*, D. (p. 583.) The salts of Zinc, although frequently given as tonics, yet are seldom administered with the view of obtaining astringent effects, except as external applications. In the form of collyria, or as lotions, both the sulphate and acetate are employed in ophthalmia and other inflammatory affections, after the excitement has been partially subdued by local blood-letting and other depleting means. There is one case on record, quoted by Dr. Christison from Pyl's Memoirs, of the external application of Sulphate of Zinc proving fatal: it was applied to cure a scabby eruption on the head, and had not been long used before the child, who was six years old and healthy, complained of acute burning pain of the head, which was followed by vomiting, purging, convulsions, and death in five hours. As I have not seen Pyl's account of the case, and Dr. Christison's quotation contains little detail, I can form no opinion of the cause of this uncommon effect of the external use of this sulphate. It may have been owing to idiosyncracy, or to metastasis by the repulsion of the eruption causing meningitis or inflammation of the membranes of the brain—an effect of local applications, in Porrigo, which I have witnessed more than once.

The dose for internal use is gr. i. to gr. vi, in any simple non-astringent Infusion or Decoction. A large dose of these salts of Zinc produces little effect on the habit, as they are constantly rejected by vomiting; but, should an overdose, to a less extent, produce pains of the stomach and bowels, retchings, and diarrhœa, these effects are best counteracted by carbonate of potassa and oleaginous mixtures.

5. NITRATE OF SILVER. *Argenti Nitras*, L. E. D. (p. 605.) This salt has never been administered internally as an Astringent; but it has been successfully employed externally in ophthalmia. In ulceration of the cornea, and in obstinate inflammation of the conjunctiva, a solution of gr. ii of the nitrate in f℥i of distilled water, is of sufficient strength: but, when the ulcers are of a nature to threaten protrusion of the iris, the proportion should be ten grains to the fluid ounce of water: and the same strength is requisite in inflammation forming granulations of the palpebræ, and in ophthalmia from gonorrhœa. In these cases, a drop or two of oil of sweet almonds should be dropped into the eye immediately after the solution has been applied. The best mode of introducing both the nitrate and the oil is to take them up with a hair pencil and to introduce its point at the angle of the eye: the fluid leaves the pencil, and immediately spreads itself over the ball of the eye and the inside of the lids. As the

animal matter instantly decolorizes the solution in distilled water, and leaves a permanent stain on the skin, the eyelids should be touched with oil before dropping the solution into the eye.

B.—SEDATIVE ASTRINGENTS.

c. *Metallic Salts.*

1. Carbonate of Lead. *Plumbi Carbonas.* L. E. D.—When metallic lead is exposed to the air, it soon acquires upon its surface a thin white coating, which is a carbonate of the metal: when it is exposed to the combined action of distilled or rain-water and air, a white insoluble powder forms, which is also a carbonate: rain-water, collected from the roofs of houses newly furnished with leaden spouts, or eave-droppings from lately erected leaden roofs, water agitated in leaden cisterns at sea, and many other conjunctions of lead and *pure* water, if air be present, produce carbonate of Lead: and it is also formed when the acetate or the diacetate of lead in solution are exposed to the air, or when hard water or solutions of salts, containing carbonates of alkalies, are mixed with their solutions.

Carbonate of Lead occurs native; but that employed in medicine is procured by exposing plates or coils of lead in pots furnished with a ledge, on which the coil rests, to the action of the vapour of vinegar, and, at the same time, to that of carbonic acid, by placing these pots in fresh stable litter. The vinegar oxidizes the surface of the lead, and converts the oxide into a diacetate of lead, which is again rapidly decomposed, and formed into the Carbonate by the carbonic acid extricated from the fermentation of the stable litter. The Carbonate is then detached from the surface of the lead, ground in water, and afterwards dried in stoves, heated by means of flues*. It is now, also, formed by transmitting carbonic acid through a solution of diacetate of lead.

Carbonate of lead is a white, heavy, inodorous, insipid powder, insoluble in water, very soluble, with effervescence, in nitric acid and strong acetic acid; and partially soluble in a concentrated solution of pure potassa. When it is exposed to heat, it is converted into the yellow protoxide. According to the analysis of Berzelius, it consists of

1 equiv of Protoxide of lead	=	111·5 or	83·5
1 equiv. of Carbonic acid .	=	22·16	16·5
Equiv.	=	133·5	100·0

It is easily reduced to metallic lead by exposing it on charcoal to the action of the blow-pipe; and is converted into the

* London Dispensatory, art. Plumbi subcarbonas.

sulphuret by sulphuretted hydrogen gas, or its aqueous solution. When adulterated with chalk, this can be easily detected by putting the suspected Carbonate into distilled vinegar, filtering and testing the fluid with oxalate of ammonia: if chalk be present, an insoluble oxalate of lime will be precipitated. The test of the Edinburgh College is a good and practical one:—68 grains of the carbonate dissolve in 150 minims of acetic acid diluted with f℥i of distilled water; and are not *entirely* precipitated by 60 grains of Phosphate of Soda.

This Carbonate is a powerful sedative Astringent; but it is never internally administered, on account of its poisonous properties. It even requires to be applied with caution to abraded surfaces. It is the preparation of lead from which colica pictonum, painter's colic, in every instance arises. The symptoms it produces, when taken into the stomach, are, at first, not unlike those of common dyspepsia: soon afterwards, obstinate costiveness, violent pain and tormina, or a sensation of twisting at the navel, supervenes; the stomach becomes very irritable, and rejects the food by vomiting; violent gripings succeed, which are temporarily relieved by pressure; the muscles of the abdomen are powerfully retracted, and the umbilicus drawn inwards. In general, there is obstinate costiveness; but sometimes diarrhœa occurs: the urine is diminished in quantity; the saliva assumes a bluish colour; and the expression of the countenance becomes dull, anxious, and gloomy. Along with these symptoms, the pulse is small, but hard; the respiration laborious; and, if relief be not soon obtained, the attack terminates either fatally in nervous apoplexy, or more frequently in paralysis of the extremities. The palsy attacks, at first, only the fingers or the whole hands, and then the lower extremities: it sometimes occurs simultaneously with the colic, although it is seldom noticed until the pain abates. In the hands, the extensors of the thumb, and those of the fore and the little finger are most affected; the flexion of the wrist is a very characteristic symptom; and the arms cannot be raised, but hang dangling at the sides. When paraplegia supervenes, the patient complains of excruciating pains of the limbs. These symptoms may arise from the conversion of the Acetate into the Carbonate in the alimentary canal.

The best remedy, when colic only is present, is castor oil combined with opium; but when there is reason to suspect that a portion of the Carbonate remains in the stomach, the sulphates of magnesia or of soda should be administered: an inert sulphate of lead is formed by these salts, and this is carried through the bowels by the undecomposed portion of them. On the same principle, alum is also useful in colica pictonum. When paralysis of the extremities occur, the best remedies are the extract of nux vomica or the acetate of strychnia, and the application of

the galvanic influence. The dose of the acetate of strychnia should not, at first, exceed $\frac{1}{16}$ of a grain; and its augmentation should be very gradual, and not pushed after tetanic twitchings appear.

The chief use of Carbonate of Lead is as a topical sedative Astringent, applied in the form of an ointment to irritable sores. It is sometimes productive of partial paralysis.

OINTMENT OF CARBONATE OF LEAD. *Unguentum Plumbi Carbonatis.* E. D.—The Edinburgh College orders ℥i of Carbonate of Lead and ℥v of simple ointment to be rubbed together: the Dublin orders ℥ii of the Carbonate and lb. i of white-wax ointment.

2. ACETATE OF LEAD. *Plumbi Acetas.* L. E. D.—According to the Pharmacopœia of the London College, this salt is prepared by dissolving lb. iv ℥ii of litharge in powder, in Oiv of acetic acid, diluted with Oiv of distilled water, aided by a gentle heat, filtering, and crystallizing. The Edinburgh College orders ℥xiv of litharge, Oii of pyroligneous acid of the density 1034, and Oi of distilled water. The Dublin, to digest Carbonate of lead in ten times its weight of distilled vinegar until the solution becomes sweet; then pouring off the solution and proceeding as before; lastly, filtering and crystallizing. The London and Edinburgh processes are the best. But the salt, even for medicinal purposes, is manufactured in the large way in Holland, and also in England. In England, it is made in the large way by acting upon litharge by pyroligneous acid of a sp. gr. 8 of Beaumé; but as the oxide is often impure, the Acetate thus prepared sometimes contains salts of copper and other impurities, and ought not to be employed in medicine.

Pure Acetate of Lead is inodorous, although the Acetate of commerce has an acetous odour; it has an astringent sweetish taste. It is generally in the form of small, glossy, needle-shaped crystals, which are flat, quadrilateral prisms, terminated by dihedral summits; but when carefully crystallized, the crystals are large. They effloresce in the air, and lose a little of their acid. Their sp. gr. is 2.345; they dissolve in 25 parts of distilled water; but, on being kept in solution, a white powder falls, which is carbonate of lead, formed from the union of the oxide of the acetate with the carbonic acid attracted from the air. This is also the case when pump or hard water is employed in making the solution. The solution of the acetate is also decomposed by all the acids which form insoluble, or nearly insoluble, salts with the oxide of lead,—the sulphuric, hydrochloric, carbonic, oxalic, and tartaric; by lime water and all the alkaline carbonates; but pure potassa and soda, if added in excess, redissolve the precipitates. Sulphuretted hydrogen precipitates it in the form of the black sulphuret; iodide of potassium, as the yellow iodide of lead; and metallic zinc reduces it to the state of metallic lead.

It is also precipitated by infusion of galls, and all astringent vegetable decoctions and infusions; and by almost all animal fluids, with the exception of gelatin.

The components of this acetate are—($\bar{A}$. + Pb. 0 + 3 Aq.)

Acetic Acid .	26·45 or	1 eq.	= 51·48
Protoxide of Lead	59·25	1 eq.	= 111·6
Water	14·30	3 eq.	= 27·0
	100·00	Equiv.	= 190·08

The best test of its purity is its complete decomposition when 47·66 grains of the acetate in solution is acted upon by 30 grains of phosphate of soda.

As a sedative Astringent, this salt is a valuable medicine, and may be given with much greater safety than is generally supposed. It acts directly upon the nerves of the stomach as a sedative astringent, gradually extending its influence to the entire system. After its employment has been continued for some days, the pulse falls in frequency and force; and, if the dose be too rapidly increased, or be too large, pains of the stomach, nausea, a diminished secretion of high-coloured urine, turgidity of the gums, constriction of the throat, and vertigo, supervene. When these symptoms occur, the use of the acetate should be immediately suspended. The writings of Sir George Baker and of Dr. Heberden did much to confirm the bad repute of this salt of lead; but subsequent experience has demonstrated that it may be administered, not only with safety, but with the greatest benefit, in all cases of active hæmorrhage. I have given it in doses of five grains, and occasionally in larger doses, washing them down with diluted distilled vinegar, for several successive weeks, without perceiving the smallest deleterious result from its employment. This mode of administering the Acetate of Lead was suggested by me, from having ascertained that the only direct poison of lead is the *carbonate*, and that acetic acid checks the formation of that salt by preventing the decomposition of the acetate in the intestines. Mr. Laidlaw, a surgeon, who made a series of experiments on himself with this Acetate, without using vinegar, took it in the solid form to the amount of gr. xii in twenty-four hours, for several successive days, without producing colica pictonum. When griping pains occurred, they were speedily allayed by increasing the proportion of the opium in the pills. Mr. Laidlaw took it also in the fluid form, in smaller doses, until gr. lxx were taken, without any deleterious result. One curious effect of its continued use was the excitement of ptyalism; but, notwithstanding this effect, it has been recommended, by Mr. Daniels, for the purpose of allaying violent salivation, in doses of gr. x to ℈i, in conjunction with gr. x of compound powder of ipecacuanha. How are these contending opinions to be reconciled? When administered in moderate

doses, it is certainly a sedative astringent. The fauces and pharynx are constringed in swallowing it. Its employment in hæmorrhages is of very ancient date; and it has been advantageously used, whatever may be the organ or part of the body in which the hæmorrhage appears. Dr. Latham introduced the use of it in colliquative diarrhœa, and in tubercular consumption, attended with ulceration; and, although I cannot say that my experience has induced me to place any confidence in it as a remedy for phthisis, yet, it certainly lessens the irritability and corrects the tendency to diarrhœa which accompany that intractible disease. It is usually prescribed with opium; but this is not essential.

Opiated Lead Pills, *Pilulæ Plumbi Opiatæ*, E. are made by beating together six parts of acetate of lead, one part of opium, and one of conserve of red roses; and dividing the mass into four-grain pills. One or two may be given for a dose, twice or thrice a day.

Acetate of Lead, combined with a quarter or half a grain of opium, may also be made into pills with the crumb of bread. Its sedative influence is augmented by the use of distilled vinegar, largely diluted, as ordinary beverage.

In prescribing this salt of lead, and all the other salts of this metal, we must keep in view the influence of idiosyncracy in modifying the operation of medicines; as some individuals are peculiarly susceptible of impressions of the most hurtful kind from the smallest doses of the salts of lead. When it happens that it proves hurtful, it may be detected by several reagents: thus, it is precipitated white, as a carbonate, by the carbonates and the sulphates of soda or of potassa; bright yellow, by iodide of potassium; and black, by the solution of sulphuretted hydrogen, forming a sulphuret of the metal. If the precipitate, by any of these reagents, be mixed with charcoal and submitted to the blowpipe, a button or globule of metallic lead will be procured.

As an external application, the acetate has been extensively employed in collyria and lotions, in all cases requiring the aid of local astringents. The dread of its deleterious properties, at one time, extended to its external employment; and it must be admitted, that instances have occurred in which the bowels have been affected even by the external application of the acetate: thus, in a case mentioned by Dr. Wall*, colic was produced by immersing the legs twice a day, for ten days, in a bath of the solution of Acetate of Lead. But such instances are rare.

Ointment or Cerate of Acetate of Lead, *Ceratum Acetatis Plumbi*. L. *Unguentum Plumbi Acetatis*, E. D. is made by triturating ʒii (℥i, E. D.) of powder of acetate of lead

* Transactions of the College of Physicians, vol. i.

with ℥i of olive oil, and adding a solution of ℥ii of white wax and ℥vii of olive oil (Ceræ ℥xx, E: ointment of white wax lb. iss, D.).

3. DIACETATE OF LEAD. *Plumbi Diacetatis Liquor.* L. *Plumbi Diacetatis Solutio.* E. *Plumbi Subacetatis Liquor.* D.—This solution is formed by boiling lb.ii ℥iii (℥iv, E.) of the acetate of lead, and lb.i ℥iv of litharge deprived of carbonic acid, in Ovi (Oiss, E.) of water, for half an hour, and filtering. The Dublin College orders one part of semi-vitrified oxide of lead, and twelve parts of distilled vinegar, to be boiled down to eleven parts, and filtered after the impurities have subsided.

According to the analysis of Dr. Bostock, the Diacetate consists of

Oxide of Lead	81.75	or 2 eq.	= 223.2
Acetic Acid .	18.25	1 eq.	= 51.48
	100.00	Equiv.	= 274.68

When prepared with common vinegar, it has a greenish-yellow colour; but if the acid be pure, it is nearly colourless. It has a sweetish, subastringent taste; and, when prepared with vinegar of a sp. gr. 1.007, it should have a sp. gr. 1.220. It is decomposed by the smallest quantity of carbonic acid contained in any water with which it is mixed: even exposure to the air converts it rapidly into the carbonate, and a few bubbles of breath thrown into it produces the same effect. It is distinguished from the acetate by its precipitating a solution of gum, for which it is a very delicate test. It is affected by the same reagents as the acetate.

DILUTED SOLUTION OF DIACETATE OF LEAD. *Plumbi Diacetatis Liquor dilutus.* L. *Plumbi Subacetatis Liquor compositus.* D.—Consists of f℥iss (f℥i, D.) of the solution of the diacetate, Oi of distilled water, and fℨii (ℨi, D.) of proof spirit. This is the only form in which it is used.

The Diacetate of Lead is never internally administered, and is the preparation of this metal, next to the carbonate, which is most poisonous; but this property depends on its conversion into the carbonate, which occurs in the stomach. I have seen more than one instance of death resulting from a large dose having been taken by mistake. It induces colica pictonum; the appetite becomes impaired, whilst nausea, and a discharge resembling that of ptyalism, supervene, accompanied with great restlessness. There is often bilious vomiting, during which the colic pains come on and recur at intervals, affecting chiefly the umbilical and iliac regions, the parietes of the abdomen feeling knotted and being drawn inwards: there are also obstinate costiveness, headache, pains of the limbs, particularly of the ankles and soles of the feet: but generally no fever. The expression of the countenance is indicative of the greatest distress; the cerebral functions become disturbed, and the patient sinks. The imme-

diate cause of the fatal termination is nervous apoplexy: the more common termination, however, is palsy, similar to that caused by carbonate of lead.

The only disease which is caused by the poison of lead is colica pictonum; and, in almost every writer upon the subject, it is stated that this colic is the result of lead taken into the habit, in whatever form it may be introduced. Litharge is stated to be a poison; because wines, in which it has been put to overcome acidity, have produced colica pictonum. In the writings of Sir George Baker and others, instances are related of that disease having arisen from the prolonged use of the Acetate of Lead; and cases are detailed in which its external application has produced similar effects. Dr. Wall has published two cases in which this colic could be unequivocally traced to the application of *Goulard's* extract to open ulcers; and one, already noticed, in which it was produced by immersing the legs in a bath of the acetate. Now, although I do not deny the accuracy of any of these facts, and admit that colica pictonum may result as a sequence to the use of any oxide or any salt of lead, yet I trust that I shall be able to prove that whatever may be the form in which the lead exists when taken into the stomach, or applied to the surface, still that it is one only of the salts of lead, namely, the *carbonate*, which is really adequate to the production of colica pictonum.

To prove this point, in the first place let us enquire, what are the occupations of those persons most liable to this disease? It will be found that miners, who dig the ore and the sulphuret, who must necessarily inhale some of the dust of these states of lead and take it into their stomachs, are not liable to colica pictonum; whilst those workmen who smelt the lead frequently suffer. It would not be a difficult task to prove that the fine exhalation of oxide of lead, formed in smelting, inhaled into the lungs, is rapidly converted into carbonate of lead when exposed to the carbonic acid in the pulmonary tubes, in combination with their heat and moisture. Next to smelters of lead, we find that manufacturers of sheet lead, plumbers, glaziers, painters, and compositors in printing offices, are most liable to colica pictonum. It is scarcely requisite to say that it is with white lead or the carbonate that these tradesmen, except the compositors, are occupied; and that it is most commonly conveyed into their stomachs with their food, owing to their uncleanly habit of taking their food without washing their hands. The compositors are not affected with colica pictonum, but with partial paralysis; and I have heard of an instance of a man, who was in the daily custom of handling pigs of lead and loading carts with them, having twice suffered with this disease. Now, I have already mentioned that the whitish efflorescences collected on the surface of metallic lead exposed to the air is carbonate of lead;

and it might not be difficult to trace this into the stomachs of those who are constantly handling lead, or to trace it into that organ in painters; but it is probable that it also acts locally on the cutaneous nerves, as compositors are merely affected with palsy in the hands. Of all artisans, however, the manufacturers of white lead are the most liable to colica pictonum. This was particularly the case when the grinding of white lead was performed in the air; the grinding houses were generally full of dust of Carbonate of Lead, and the men, consequently, received it into the lungs and into the stomach. For many years I had the medical management of a very large white lead manufactory on Thames' bank, and, before the process of grinding white lead under water was adopted, I had frequently to prescribe for several of the workmen labouring under colica pictonum: but, after the use of water in the grinding part of the process was adopted, very few cases indeed of the disease occurred. In every instance in which white lead finds its way into the stomach, colica pictonum follows; whereas the acetate has been taken in large doses, and for a long period, without any injurious consequences. There is, therefore, sufficient reason for affirming that carbonate of lead is the most poisonous of the salts of lead; but I have also ascertained, by a series of experiments on rabbits*, that it is actually the only poison among the salts of lead.

The question next occurs, in what manner is the lead, which is taken into the stomach in wine, cyder, and other means, rendered poisonous, if the carbonate only operate as a direct poison? I reply, that these liquors, when rendered poisonous by admixture with litharge or with sugar of lead, contain the poison in the form of the citrate, or malate, and which is rapidly converted into the carbonate in the stomach. In this state, it acts upon the nerves of the intestinal canal, producing the disease in question. If we trace the history of the cases of poisoning by salts of lead, we shall find that the danger is in the direct ratio of the facility with which the salt of lead that has been swallowed can be converted into the carbonate. It is on this account that the diacetate is so much more poisonous than the acetate; for, next to the carbonate, it is the most poisonous of the salts of lead. In some habits, and in the same person at different times, a greater quantity of carbonic acid than usual is evolved in the intestines. These conditions of the habit indicate a lower state of vitality than is requisite to maintain the healthy condition of the system; consequently I presume that the same quantity of the acetate, or of any other of the salts of lead, will be more quickly changed into the carbonate under such circumstances, than in more healthy individuals. This supposition is partly

* See Medical Gazette, vol. x, p. 689.

confirmed by the following anecdote. A gentleman returned twice from the West Indies, suffering under palsy, the sequel of colica pictonum, or dry bellyache, as it is termed in the West Indies, produced by drinking daily a beverage made of rum distilled through a leaden worm. Many others had partaken of the same rum without being afflicted with the colic; I was, therefore, anxious to ascertain the cause of his being so particularly its victim; and, on making strict enquiry into the facts, I discovered that he was in the habit of drinking soda powders, containing bicarbonate of soda, at the time of drinking his toddy—a fact which at once fully elucidated the cause of his sufferings. Another fact which supports the theory which I have ventured to advance, is this—that those who take the Acetate of Lead medicinally, in the liquid form, in combination with distilled vinegar, or who drink diluted distilled vinegar, to wash down pills of the acetate, are able to take it in larger doses, and for a much longer period of time, with impunity, than those who take it without this adjunct.

The manner in which the carbonate acts upon the habit is not so easily explained. As an Astringent, it corrugates the circular fibres of the intestine: whilst, at the same time, it exhausts the energy of the motor nerves, producing paralysis of both the upper and lower extremities. The fact of the action of the carbonate of lead on the muscular fibre is demonstrated by post-mortem dissections: the colon is generally much contracted; and, when the disease has been of long continuance, or has frequently occurred in the same individual, the intestines are found almost exsanguine, tender, and with an evident disposition to run rapidly into putrefaction. The mesenteric glands, also, in such cases, have been found enlarged. In experiments made upon the lower animals, when the paralysis is not of long standing, the whole muscular system is found pale, bloodless, and flaccid: but no other part indicates the presence of disease. In this respect, therefore, the salts of lead act through the nervous system in the same manner as narcotic poisons, exhausting the motor nerves of their energy; but in a degree adequate only to the production of paralysis. In fifty cases, dissected by *Seuve*, of individuals who had died of colica pictonum, no morbid appearances could be traced. Gmelin asserts that the salts of lead may be detected in the bodies of those who have died of colica pictonum: and Wibmer also says that he detected traces of them in the intestines, liver, lungs, blood, urine, or fæces of the animals destroyed by them. The experimentalists of the Veterinary School of Lyons found the blood in the veins of a dog, who had been poisoned by litharge, of a vermillion colour, and that in the arteries brighter than usual. Having destroyed a dog by injecting a solution of the acetate into the jugular vein, the pink colour described by the

veterinarians of Lyons was perceived in the blood. From these facts, it is evident that, in cases of poisoning by salts of lead, when the issue is fatal, little satisfaction can be obtained from the post-mortem inspection of the body; and much of the evidence must be drawn from the nature of the symptoms and the analysis of any portion of the poison which remains.

With regard to the practical inferences to be drawn from the theory which I have ventured to advance, I would say—1, that the acetate of lead is the least poisonous of all the salts of lead *medicinally* employed: 2, that its safety is increased by the addition of as much diluted acetic acid as can prevent its decomposition by animal matter and carbonic acid in the stomach and bowels; 3, that the administration of alkaline carbonates in cases of poisoning by Acetate of Lead is highly improper; 4, that the Diacetate, under no circumstances, should be internally exhibited; 5, that the carbonate should be applied with caution, even to external sores.

The first thing to be done in cases of poisoning by any salt of lead is to evacuate the stomach by means of the stomach pump or the acetate of zinc; then to exhibit sulphate of magnesia or phosphate of soda, both of which, by reason of their acid bases, decompose the salts of lead, and convert them into insoluble inert compounds, which are carried through the bowels by the undecomposed portions of the above salts. The remainder of the treatment consists in the repeated exhibitions of oleaginous purgatives, particularly castor oil, in conjunction with narcotics: whilst, at the same time, the warm bath should be used. In the early stage of the disease, when the pulse is full and hard, bleeding has been resorted to: but I have never seen a case in which it was required. When the paralysis of the extremities has commenced, the treatment with acetate of strychnia, and passing a current of electricity, by the Electro-magnetic apparatus, through the abdomen, are the best remedial means that can be adopted. It is of great importance to caution workmen, who from the nature of their employment are constantly handling white lead, or even metallic lead, never to take a meal without washing their hands; and to endeavour to convince smelters and other manufacturers of the metal, exposed to its fumes, to have some means of carrying off theso exhalations, which prove so injurious to their health.

The custom of prescribing infusion of roses, acidulated with sulphuric acid, at the same time with pills containing the acetate of lead, in hæmoptysis and other hæmorrhages, is improper: the salt of lead being decomposed, as soon as the infusion enters the stomach, by the sulphuric acid; and, consequently, in these cases, if any benefit be received, it can only be justly ascribed to the sulphuric acid, and in no degree to the salt of

lead. Indeed, a more decided method of destroying the action of any salt of lead could not be adopted.

* * *Imponderable Agents.*

COLD.

Cold is a negative property, being the mere absence or abstraction of a positive quality, *Caloric.* It may be employed to operate as a sedative astringent, through the medium of *Water* and of *Evaporating Lotions.*

Cold, when applied to the living body, or rather the sudden abstraction of caloric from the living body or any part of it, causes a peculiar sensation, which is accompanied with paleness and corrugation of the skin. This is the result of a contraction of the capillaries; and so far it operates in a manner somewhat resembling its action upon dead animal matter. In the living body, however, its influence is not confined to the surface; it extends to internal and distant parts; and, owing to this sympathetic action, the entire system feels the influence of Cold when applied only to a part. This is well illustrated in epistaxis, which is often checked by cold bodies applied to the neck, the back, or even to the genital organs. In reference to the surface, the first effect of cold is truly astringent, in the strict meaning of the term; but this is transient; a reaction occurs in the system, during which a hæmorrhage that has been checked is very apt to return with redoubled violence. To render Cold, therefore, beneficial as an Astringent, its application must be continued for some time; in which case, its power of checking hæmorrhage is to be ascribed as much to its sedative as to its astringent influence.

The effects of cold vary according to the nature of the medium employed. Thus, cold, humid air abstracts caloric more quickly from the body, than dry, cold air: and the effects of cold water, applied under exactly the same circumstances of the body, differ according to the purity of the water. Count Rumford states that the conducting power of moist air to that of dry air is as 330 to 80; and it is even greater than that of water, which is only 313. I might here suggest a question which has often presented itself to my mind in reflecting upon this effect of moist air—"What influence has this depressing power of a humid atmosphere in the production of agues?" This is a question which I cannot pause to investigate; but it is one of much importance in a practical point of view.

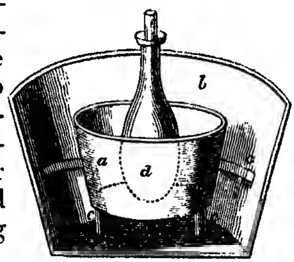
The following experiment demonstrates that much of the diversity in the sedative or astringent influence of cold water depends on its purity. Dr. Currie immersed one person in sea water and another in fresh water for thirty-five minutes: the sea

water caused no inconvenience, whilst the fresh water lowered the system so much that friction was necessary to restore the natural temperature. In the application, therefore, of Cold, as the means of stopping hæmorrhages, we must bear in remembrance that it is the continued application of the Cold that effects the benefit.

The hæmorrhages in which Cold exerts the greatest influence are, undoubtedly, those of an active description: and hence the necessity of its continued application for some time after the flow of the blood has ceased.

In summer, when ice and cold water cannot easily be procured, it is of importance to know the best frigorific mixtures where snow or ice is not necessary.

1. Five parts of hydrochlorate of ammonia, + 5 of nitrate of potassa, + 16 of water, sink the thermometer from 50° to 10°: —2. The same, with the addition of 8 parts of glauber salts, sinks it to 4°:—and, by various combinations of this kind, great artificial Cold may be procured. When ice can be procured, an excellent frigorific mixture is obtained by stirring together equal parts of pounded ice and fused chloride of calcium. In making frigorific mixtures, it is necessary to cool down the vessels and the water, and to envelop the vessels in flannel or some other non-conductors. This is well understood in warm climates, where ice is regarded as a necessary of life. Thus, the Neapolitan peasants, who carry snow from Vesuvius to Naples, during the heat of summer, envelope the vessels in woollen cloth. The vessel containing the ice should be placed within another, holding ice also, the inner one being supported by corks, which are bad conductors (see marginal figure:—*a* the inner vessel, *b* the outer, *c c c* corks to support the inner, *d* the bottle containing the water to be frozen). A temperature of 32° Faht. is adequate for every purpose which can be expected from the influence of Cold in checking hæmorrhages.



Evaporating lotions operate also as Astringents, by reducing the temperature of the part to which they are applied: but as the effect is more slowly produced and also less permanent, they are not so frequently employed as cold water and ice; although the stimulant nature of some of their components—alcohol, acetic acid, and ether, for example—add greatly to their astringent influence. They are more employed as direct refrigerants than as Astringents.

Such are those Astringents that exert a sedative influence on the living system: a few brief remarks will suffice for those that operate as chemical agents.

c. SUBSTANCES OPERATING CHEMICALLY AS ASTRINGENTS.

Carbonate of Lime; Prepared Chalk. *Creta.* L. E. D. *Creta preparata.* L. E. D. *Carbonas Calcis precipitatum.* D.—The first-mentioned preparation of the Dublin College, which is the result of the precipitation of the chloride of calcium by carbonate of soda, washing the precipitate and drying it on a chalk-stone and paper, is expensive; consequently it is seldom employed, and the Prepared Chalk is used in its stead. It is prepared by triturating the chalk with a little water to a fine powder, then throwing it into a large quantity of water; and, after the grosser particles have subsided, pouring off the turbid supernatent fluid, which is then allowed to clear. The subsided powder is dried for use.

As an Astringent, pure Lime, in solution as lime water, operates, both by its chemical property of uniting with acids, and also by its sedative influence, on the irritability of the living animal fibre; but it neither corrugates nor condenses that fibre; and, therefore, in strict language, it is not an Astringent.

Carbonate of Lime, or Chalk, is found abundantly in the latest secondary strata in many parts of the world; and, in particular, in the southern portion of this island, in massive beds, traversing it in a range which commences at Flamborough Head, in Yorkshire, and passes through Lincolnshire and the midland counties to Surrey, Kent, Sussex, Hampshire, and Dorsetshire. It is generally pale yellowish-white, or snow-white, opaque, of a dull lustre, friable, inodorous, insipid, and adhering slightly to the tongue; it effervesces with acids, forming salts of various kinds, and generally contains about 56 per cent. of Lime.

Chalk operates solely by uniting with the acid in the stomach and intestines, which often produces and always keeps up diarrhœa. It is administered in the form of mixture, and is usually combined with aromatics. It also enters into the composition of two powders and a lozenge.

Mixture of Chalk. *Mistura Cretæ,* L. E. D.—Each of the Colleges has its own formula for this mixture. The London orders ℥ss of prepared chalk and ʒiii of sugar to be mixed with f℥iss of mucilage of gum-arabic, and f℥xviii of cinnamon water; the Edinburgh directs ʒx of prepared chalk and ℥v of pure sugar to be triturated with f℥iii of mucilage, fʒii of spirit of cinnamon, and Oii of water; the Dublin differs from the London only by the employment of f℥xvi of water, instead of cinnamon water. This mixture is incompatible in prescriptions with medicines containing tannic acid, as, for example, infusions of galls or other astringent vegetables, or acidulous salts which contain an acid that forms an insoluble compound with Lime, and all the metallic salts.

Compound Powder of Chalk. *Pulvis Cretæ compositus,*

L. E. D.—The London and Dublin Colleges order lb. ss of prepared chalk, ℥iv of cinnamon, ℥iii of tormentil and gum-arabic, and ℥ss of long pepper, to be powdered and mixed together; the Edinburgh formula is ℥iv of prepared chalk, ʒiss of powdered cinnamon, and ʒi of powdered nutmeg.

Compound Powder of Chalk with Opium, *Pulvis Cretæ compositus cum Opio*, L. D. *Pulvis Cretæ Opiatus*, E. is made by adding ℈iv of powdered opium to the above powder.

Chalk Lozenge. *Trochiscus Cretæ*, E.—℥iv of prepared chalk, ℥i of gum-arabic, ʒi of nutmeg, and ℥vi of pure sugar, are reduced to powder, and beat with a little water into a mass for making lozenges.

After Chalk has been used for some time, the bowels should be cleared out, as it is apt to form into hard balls, and to lodge in the folds of the intestines.

THERAPEUTICAL EMPLOYMENT OF ASTRINGENTS.

In a therapeutical point of view, *Astringents* are very important medicines, although the range of diseases in which they are indicated is very limited; being confined almost to two classes—hæmorrhages, and that which Nosologists have denominated profluvia, in which there is an inordinate excretion, naturally not sanguineous.

No remedies are so important in hæmorrhages as Astringents; but they are not to be indiscriminately employed, nor is it at all times to be administered: it is therefore of importance to enquire what are the symptoms indicating their use in hæmorrhagic diseases? Hæmorrhages may be regarded as *active* or *passive;* but in neither is it essential that there should be any rupture of vessels. Active hæmorrhage occurs in the *young*, the *robust*, and the *plethoric*. Its exciting causes may be very different; it may, in some instances, be spontaneous, an effort of nature to relieve the blood-vessels morbidly oppressed by fulness; that state which has been termed *molimen hæmorrhagicum:* occasionally it proceeds from *exposure to heat;* or it may follow strong *mental emotions*, as, for instance, bursts of anger or rage; or it may result from *over-exertion* of the muscular powers, as in violent exercise. In this form of hæmorrhage, the blood escapes rapidly, is of a florid colour, and readily coagulates, although it does not separate distinctly into serum and crassamentum. As the blood flows, the patient becomes conscious of being relieved of something which had previously oppressed him: it therefore, in a great degree, becomes its own remedy; it frequently spontaneously ceases, and only becomes dangerous when the quantity of blood lost is excessive. In this sort of hæmorrhage, it is scarcely necessary to say that *tonic* Astringents are improper, and that the use

of those exerting a sedative influence should not be hastily resorted to, until the vessels be relieved by the flow of the hæmorrhagic effort, or be unburthened by the use of the lancet.

Passive hæmorrhage is characterized by an opposite state of things. It takes place in the feeble and relaxed, who have been ill nourished, or suffered from over-fatigue, or been weakened by disease. The effused blood is of a dark colour, or has a watery aspect, does not coagulate, and is often poured forth from different parts at the same time. If the quantity lost be considerable, the face becomes pale, the body loses its heat, and there is great danger of life. In this condition of the system, the tonic Astringents are decidedly indicated, and should be liberally employed. To illustrate this point, let us suppose a case of bleeding from the nostrils, epistaxis, in two boys, one of a full, strong, plethoric habit of body; the other weak and emaciated, pallid, and flabby in the solid parts of his frame. In the first, the bleeding may be critical, or connected with congestions or determinations of blood to the head. It ought not to be suddenly checked, unless it becomes so profuse and long continued as greatly to lower the pulse, to produce syncope, or exhaust greatly the powers of life. On the contrary, in the weak boy, or if the patient be an old man, in which case epistaxis is often an indication of liver disease, the loss of blood should be as rapidly checked as possible; and, for this purpose, tonic Astringents should be freely administered and applied. The best Astringents in the *first* case are the *salts of lead;* those in the *second,* the other metallic salts, injected into the nostrils, or applied on lint soaked in the solution of the salt; whilst, at the same time, gallic acid is taken in moderate doses into the stomach, and cold applied to the face and the nape of the neck, or dashed upon the genitals. The Astringents most frequently used are alum and tincture of galls. The solution of gallic acid, however, in weak alcohol is still better than either of these. The strength of the solution is to be regulated by circumstances; but, as a general rule, ℈i to f℥i of diluted alcohol is sufficient.

Hæmoptysis occurs especially at that period of life when the animal frame has just acquired its full growth. Before this time "the impetus and determination of blood are greater in the aorta and its extreme ramifications than in the pulmonary system;" but when the necessity of a further elongation of the aortic system ceases, the bias is thrown upon the pulmonary vessels, in which there is a tendency to accumulate, from their shorter extent; and if these vessels be not equal in the strength of their coats to the additional burthen, they become relaxed and exhale the blood, or they even may give way from a variety of causes; as, for example, violent muscular exertion, sudden exciting passions of the mind; vomiting; coughing; a suppressed dis-

charge from the hæmorrhoidal veins in bleeding piles; or from whatever suddenly throws an additional jet of blood on the already overloaded vessels. The obscurity in which the causes of hæmoptysis are often involved is very great. I attended the late Charles Mills, the Historian of the Age of Chivalry, who was attacked with hæmoptysis when walking very leisurely in the street. The application of Cold, in the manner which I have already described, the administration of ice internally, and the free exposure of the trunk of the body to cool air, with the internal exhibition of acetate of lead, soon checked the flow of blood. He recovered, and lived upwards of twelve years after this attack, although the spitting of blood occasionally recurred. This is one of the many instances which have come under my care, in which the flow of blood, evidently from exhalation, not rupture of the vessels of the lungs, has been staunched by the proper application of Cold, under the form of ice and cold air.

In hæmoptysis, when the blood-vessels are over-loaded, and the system not in an exhausted state, if rupture be suspected, the use of Cold should be delayed for a short time, to permit the vessels to unload themselves; after which, rest, cold air, ice, or the immersion in water nearly at the freezing temperature, will be found the most effectual means of checking the discharge.

In hæmoptysis, in which the flow of blood is the result of exhalation from the coats of the bronchial vessels, if the excitement be great, the lancet may be employed, after which cool air, cold water, and ice, applied to the chest, must be resorted to, keeping, at the same time, the lower extremities warm, in order to insure a more equal distribution of the blood, and to prevent it from accumulating upon the pulmonary vessels: the energy of using these should be regulated by the state of the pulse. If the circulation indicate increased force, as well as acceleration, the sedative Astringents are internally indicated; the acetate of lead, in doses of four, six, or eight grains, should be administered, and its poisonous tendency, by a transformation into the carbonate, be guarded against, by diluted acetic acid. I am well aware that the activity of the acetate is diminished in proportion as it is prevented from assuming the state of carbonate; but that is no reason for its administration in the state of the carbonate; for we are by no means authorized to hazard the life of our patient in one way, to save him from death in another. We have no right to poison our patient, to save him from dying from loss of blood. When the acetate of lead is guarded by acetic acid, I have given it to the extent of eight and ten grains, every third hour, for ten successive days, without any symptoms of colica pictonum supervening. When the loss of blood is considerable, these measures should be pushed vigorously; but if the strength seem to fail, it ought to be maintained by means of the sulphuric acid, largely diluted, and administered in an infusion

of rose petals, or some other vegetable Astringent, taking care not to give it at the same moment as the acetate of lead, as the sulphuric acid would immediately decompose the acetate, and form an inert, insoluble sulphate of lead; thus destroying the influence of both the acetate and the acid. When the hæmoptysis is not of an alarming character; when it is not connected with a predisposition to phthisis, and is critical; or connected with suppressed menstruation, or suppressed bleeding piles; then less energetic measures should be adopted.

Hæmatemesis rarely occurs but as a consequence of debility; or vicarious, from irregularity in the menstrual discharge: it is seldom idiopathic; and, consequently, the propriety of prescribing Astringents must depend on the primary causes of the disease. The exhaustion which occurs, and the prior state of the habit, whether relaxed and languid, or otherwise, points out the *passive* or *active* nature of the attack. We have here the great advantage of applying the astringent directly to the tissue effusing the blood, as if we were restraining an external bleeding from the rupture or division of vessels. Hence, the solution of gallic acid in water instead of alcohol should be administered, unless the exhaustion be so great as to demand the addition of some cordial. In combination with gallic acid, Cold should also be employed as an Astringent; and both the enemas containing the gallic acid and the solution of that acid, administered by the mouth, should be cooled down to 32°, whilst, at the same time, ice may be applied over the abdomen. Such measures, however, cannot be resorted to in debilitated habits. It has been stated that no remedy is so beneficial, however, as the acetate of lead combined with opium; but the opium, in some degree, counteracts the sedative influence of the acetate, which, in this case, operates by its simple astringent property, as applied to the coat of the stomach, and not by its sedative power. Dr. Elliotson strongly recommends oil of turpentine in hæmatemesis and melœna. In pure hæmatemesis, I have had no experience of its influence; but in melœna it certainly acts with great energy. It may be proper to mention that, in this latter disease, besides the vomiting of blood, there is a copious discharge of black, grumous, pitchy, often highly fœtid matter by stool; and it may generally be traced to some constitutional disorder, or local organic disease, as its primary cause. The mode of administering the oil of turpentine in this case is in doses of m. xx to m. xxx in infusion of cinnamon bark. In all bleedings from the intestines, the effect of Cold, as an auxiliary, is most efficacious. If a vessel have given way in the rectum, Cold can be directly applied to the part, either by the introduction of a piece of ice, cut round so as not to irritate the gut, or by the injection of iced water, which is perhaps preferable to the ice itself, as something is also effected by the distension of the gut.

Hæmaturia is generally owing to some disease of the bladder of urine, or of the prostate gland; but, without neglecting the primary disease, much advantage is derived from the free administration of a solution of gallic acid, in a cold infusion of uva ursi. The acid passes through the circulation, and is directly applied to the bleeding surface.

In Menorrhagia, when there is general debility, internal remedies are indicated, and the sulphuric acid, in infusion of roses, is one of the best; whilst either simple cold water, or cold water containing in solution a small quantity of gallic acid, may be injected into the vagina. As a general rule, half a drachm in a pint of water is a proper strength for such a lotion.

But, in uterine hæmorrhages, Cold can be most effectually applied by means of the stomach pump, sending a continued stream of cold water upon the surface on which the vessels are pouring out their blood. In this case, we act in the same manner as in stopping hæmorrhage from a bleeding stump after amputation, when a number of small vessels have not contracted and continue oozing out blood. I may here mention a useful fact—that, in cases of uterine hæmorrhages, the greatest advantage is obtained when the Cold is applied in a peculiar manner recommended by Dr. Gooch—namely, by dropping cold water from a height of several feet upon the abdomen, which produces an instantaneous contraction of the uterus.

In every instance of general hæmorrhage, more or less hazard always exists, even when the bleeding tends to relieve a condition of plethora; and it may tend to induce some dangerous disease, if it do not directly prove fatal: or the debility which follows may be such that it cannot be repaired. In some cases, also, hæmorrhage, as Dr. Cullen long ago remarked, has a tendency to favour the plethoric state it was meant to relieve, and thereby to induce a habit which may be attended with danger.

In *active* hæmorrhages, when Astringents are required, the preparations of lead are to be preferred; in *passive*, we may select any of the vegetable or fossil Astringents; and, among these, alum and gallic acid are both powerful and safe. In other respects, it is preferable to most others; it may be combined with sulphate of iron or of zinc without decomposition, and even with aromatics, if the exhausted condition of the patient require such a prop.

For external application, *cold water* is the best Astringent; but, whatever is the agent employed, the object, if rupture of a vessel exists, is to form a clot over the bleeding orifice, and to leave Nature undisturbed to perform her curative process. When the vessel is again a continuous tube, the clot will fall off, and leave the part comparatively sound and sufficient for its function.

Although, in most of the idiopathic active hæmorrhages, the blood escapes by exhalation; and some, also, which are symptomatic of diseased structure—such, for instance, as occur in incipient scirrhus of the stomach, or which proceed from mucous membranes affected with violent inflammation: yet, in this state, the tonic Astringents are undoubtedly improper, and even those exerting a sedative influence should not be employed until the vessels are relieved either by blood-letting, or by the spontaneous bleeding, if rupture have taken place. In the second state, passive hæmorrhage, the animal fibre is lax and weak; the blood contains few red particles, compared with those which afford it the florid hue which characterizes its healthy condition; and these are diffused in a superabundant proportion of serum. This change in the relative proportion of the compounds of the blood is demonstrated in sea scurvy, and that singular disease which so closely resembles it, Purpura *hæmorrhagica:* in both cases there is great general debility of the system. In this state of the habit, tonic astringents in combination with purgatives are most advantageously employed to check hæmorrhage, and they may be liberally administered.

In description, these opposite states of the system appear perfectly obvious; but much judgment and attentive observation are often required to distinguish between them in practice. What, for instance, are the circumstances under which Astringents are to be employed in Epistaxis, or bleeding from the nose? When this flow of blood occurs in persons about the age of puberty, and especially those of plethoric habits, it may be critical, or connected with particular congestions, or with a determination to the head. It must not be checked by Astringents; unless it have been so profuse and long continued that the pulse has become weak, the face pale, and the strength is much exhausted. On the contrary, when bleeding from the nose occurs in debilitated habits, in old persons, when it is of an atonic character, or when it is symptomatic of some diseased organ—as, for instance, the liver—then Astringents, although they may be employed to check the direct loss of blood, yet, they cannot be relied upon for removing the exciting cause of the hæmorrhage. The best Astringents in these cases are those that produce a general sympathetic influence, such as cold water applied to the face and back of the neck; solutions of the metallic salts and of alum, snuffed up the nostrils, or applied by means of dossils to the bleeding vessels; and, for internal administration, infusion of roses or solution of kino, or some other of the astringent vegetable substances, acidulated with diluted sulphuric acid.

In hæmorrhoids, the propriety of employing Astringents depends altogether on the remote cause of the disease. The most common of these is a confined state of the bowels; hence purgatives, or rather laxatives, are indicated: when there is heat,

hardness, and much pain, leeches should be applied; but after these symptoms are removed, or where they are absent, when the piles are large and the bleeding excessive, then Astringents should be employed. A pint of cold water thrown into the rectum every morning, by means of a gum elastic syringe, an ointment composed of powdered gall-nuts, or of kino or catechu and lard, or the solution of the sulphate of zinc with alum, may be administered. When hæmorrhage proceeds from a ruptured vessel high up in the rectum or in the colon, the stomach pump should be used, either to throw in cold water, or infusions of the astringent vegetable bodies, or solutions of the saline Astringents. Whatever be the nature of the astringent solution or infusion, the quantity should not be such as to irritate by distension, or to cause too rapid an evacuation of the injected fluid. Accompanying this state of the hæmorrhoidal vessels, we not unfrequently find prolapsus ani, or falling down of the fundament: it also occurs occasionally in children and in old people, from mere debility, on the slightest effort to relieve the intestines of their contents. The return of the gut in this state is easily effected; but it is only by bracing and invigorating the loose and relaxed membrane that we can expect it to retain its proper place. This is best accomplished by astringent injections; and nothing is better than the infusion of the pomegranate bark, or that of balaustines.

In *Dysentery*, the use of Astringents is indicated; but their employment requires great caution. Whatever may be the cause of the attack, whether contagion, cold, or vitiated food, dissections of fatal cases have displayed traces of inflammation in the mucous coat of the larger intestines; and there is every reason for believing that no case of dysentery, which has run on beyond the first stage, has ever occurred in which inflammation was absent. If Astringents be indiscriminately employed, they increase the inflammatory tendency, with all its consequences, and produce meteorismus: hence, when it is of an acute kind, Astringents are not indicated, unless diarrhœa continue after the inflammatory symptoms have been removed, and threatens to cause dangerous debility. In such a state, small doses of kino, or of extract of Logwood, alternated with the compound powder of Ipecacuanha, will prove useful: or alum, rhubarb, and opium may be administered.

When Astringents are given whilst the griping and tenesmus are present, they have generally been found to augment these symptoms. There is indeed but one circumstance which can authorize their exhibition under such circumstances; namely, when there is a copious discharge of blood; in which case, the diluted sulphuric acid and alum are the remedies to be relied upon. In the decline of the disease, also, those substances that produce an astringent effect by their chemical influence in neu-

tralizing acid, may be advantageously employed; and with these, as well as with the other Astringents, opium may be beneficially combined, particularly when the patient is still harassed with gripings. Great advantage is also obtained, in this stage of the complaint, from the use of the mineral acids, with sulphate of zinc, or sulphate of copper, or alum and opium: and a medicine is thus obtained which, at the same time that it exerts a powerful astringent influence on the sanguineous and secerning systems, tends to increase rather than to diminish the peristaltic motion of the bowels. Nitric acid, in combination with double the quantity of hydrochloric acid, largely diluted with some Astringent vegetable infusion, is also highly proper and very beneficial in this stage of dysentery.

It is in chronic Dysentery that astringents prove serviceable; and those most to be depended upon are Sulphate of Copper, or Sulphate of Zinc in combination with opium. Alum is sometimes added; and a compound is thus formed which exerts, at the same time, a powerful astringent influence, and a tendency to increase rather than to diminish the peristaltic movement of the intestinal canal. None of the vegetable Infusions is a better vehicle for the sulphuric acid than the decoction of Simaruba bark. If ulceration of the rectum be suspected, weak solutions of the Sulphates of Zinc or of Copper,—namely, from gr. vi to x of the former, and gr. iii or iv of the latter, in ℥iv of water,—may be administered in the form of enema.

In *Diarrhœa*, circumstances often indicate the necessity of administering Astringents: but in no case should they be resorted to, until we are satisfied that no inflammatory symptoms are present; and we must preserve in recollection the fact, that when astringents are not clearly indicated, they always do harm. When diarrhœa is the result of atony or relaxation, Astringents always prove beneficial, and the only desideratum is the choice of the substance to be employed. In an acescent condition of the alimentary canal, those Astringents which, from their chemical properties, are calculated to neutralize acid, present themselves, if the morbid action of the intestines depends on the acrimony of vitiated secretions: after removing these by a purgative, we should administer the sedative astringents, or mild astringents combined with opium; or finally, if the diarrhœa be the result of loss of tone, whether arising from general or local causes, those astringents which exert a tonic influence—namely, tannic and gallic acid, krameria, tormentilla or balaustines, in combination with aromatics—are chiefly to be depended upon. Dr. Pemberton held an opinion that kino exerts a specific influence, and that it operates as an astringent only when diarrhœa is present. He administered it in doses of ℈i, combined with confection of opium. M. Bally, from having observed the influence of kino in some cases, in the Hospital La Pitiè, was led

to assert that kino cures diarrhœa, even when febrile symptoms are present—an opinion at variance with general experience.

Logwood, tormentil, bistort, and some other astringents, were formerly more employed in diarrhœa than they are at present. I have found much advantage from extract of logwood in that species of diarrhœa which attends a disease in children simulating Hydrocephalus, but not of an inflammatory character; on the contrary, demanding cordials instead of depletion.

In chronic diarrhœa, lime water and milk was a favourite remedy with the old practitioners: but that mixture possesses little astringent power, and is now very seldom prescribed.

In *Diabetes*, Astringents have been employed, from the idea that the disease depends upon the laxity of the renal vessels. They were recommended by Celsus, who used strong, *rough* wines, which were supposed to produce their benefit by constricting the extreme vessels of the kidneys: but although, in this way, they may diminish the quantity of the urine, yet, they do not alter its saccharine quality. Sydenham recommended the pomegranate bark; Morton, rhubarb; whilst catechu, kino, uva ursi, alum, sulphate of zinc, have each had its eulogist. Dr. Ferriar published an account of three cases cured by a combination of cinchona bark, uva ursi, and opium, in the proportion of a scruple of each of the former, and half a grain of the latter, administered four times a day, using lime water for drink. Many other physicians have recorded successful cases treated with astringents: but my own experience does not authorize me to recommend them strongly to your notice in Diabetes. They are, nevertheless, excellent auxiliaries to opium and other more important remedies.

In immoderate sweating, *Ephidrosis*, Astringents prove very salutary. This affection is generally symptomatic; and can, therefore, be cured only by curing the primary disease. It has, however, in a few instances, been idiopathic, or the accompaniment of general debility; in which case, the diluted sulphuric acid, in combination with infusion of krameria, or some other of the vegetable Astringents, is indicated. When the disease is not chronic, Astringents are less useful.

In virulent gonorrhœa there has been much diversity of opinion respecting the use of Astringents; for whilst, on some occasions, they appear to check the disease, on others they have increased both the discharge and the inflammation. In the incipient stage of gonorrhœa, when there is a slight turgescence only of the lips of the urethra, and no discharge has yet appeared, an astringent injection, moderately stimulating, will sometimes altogether arrest the progress of the disease. Astringents are, also, useful when there is no pain or scalding in passing the urine, although a discharge is present. For this purpose, sulphate of zinc, or sulphate of copper, in small quantities in

a large proportion of water, answers well; but when pain and scalding are present, an injection, consisting of acetate of lead, sulphate of zinc, and opium, of each x gr. in six ounces of distilled water, and an ounce of mucilage of Acacia gum, without subjecting the mixture to filtration, is of more use than any other kind of injection. When chordee is frequent and painful, accompanied with sympathetic pains of the loins, the groins, or the thighs, and much general excitement, Astringents prove injurious.

The employment of Astringent injections, in any form of gonorrhœa, has been strongly objected to by some practitioners, under the supposition that they tend to induce strictures; an opinion, however, which is not supported by experience. On the contrary, strictures are the result of long, uncontrolled inflammation in the urethra. When gonorrhœa occurs in women, strong astringent injections may be freely used. In both sexes, however, they are now much less employed than they were half a century ago.

In *Leucorrhœa*, a disease in which the natural mucus of the vagina is greatly augmented, sometimes owing to a peculiar chronic inflammation of the part, astringent injections have been freely employed. Before prescribing Astringents, it is requisite to discriminate between this inflammatory affection and a discharge arising from mere laxity of the parts. In the former state of the case, leeches should be applied to the groins, the labia, or the back, and accompanied with low diet and other antiphlogistic means, before astringent injections be ventured upon. As injections, the salts of lead, alum, and the sulphate of zinc, have been most commonly ordered; but none of the metallic salts can be compared, in these cases, with the nitrate of silver, in the proportion of three grains to f℥ss to f℥i of distilled water, and guarded by a few drops of nitric acid, which prevents the metallic salt from suffering decomposition. The vegetable astringents are, also, frequently used; namely, decoctions of oak-bark, of galls, solutions of kino, green-tea, and similar substances. When alum or nitrate of silver is employed, it is always proper to wash out the vagina with cold water after using the injection, as the coagulated discharge is apt to cause irritation, so that the injection rather augments than diminishes the evil.

In *calculous affections*, when the tendency to the formation of the phosphates exists, Astringents have been found beneficial, and the most useful are the mineral acids, and bitter, vegetable Astringents, namely, uva ursi and the pariera brava. The object, in such cases, is not to operate upon the kidneys, or to produce an increased secretion of urine, which is generally sufficiently abundant; but to allay irritability, to give tone to the stomach, and to promote a more healthy secretion of chyle. The derangement of the stomach is, indeed, productive of both forms

of calculus, namely, the acid, and the alkaline or phosphatic; but, in the latter, the influence of Astringents favours that state of habit which is opposite to their formation, or, in other words, seems to arrest the progress of the calculous diathesis.

In that form of *Aphonia*, which is termed whispering hoarseness, depending upon atony or relaxation of the vocal cords, in consequence of over-exertion of the voice in speaking, singing, or shouting, and which occasionally follows inflammatory attacks of the vocal organs, a combination of stimulants and astringents is highly serviceable. Gargles of alum, or krameria root, acidulated with hydrochloric acid, may be used, and their influence aided by a strong syrup of horse-radish, taken in small doses, and allowed to dissolve slowly in the mouth, so as to stimulate the relaxed organ as it passes over its vicinity.

As external applications, Astringents are applicable to a great variety of diseases. In ulcers, characterized by a livid aspect, with a thin, acrid discharge, the solutions of the astringent metallic salts, or powdered galls, or kino, or catechu, or rhubarb, in conjunction with compression, are of the utmost benefit. In many local inflammations, such as burns, scalds, and excoriations, Astringents have proved beneficial; and this is also the case in those inflammatory eruptions attendant on febrile affections, which are accompanied with pain, heat, and itching; namely, erythema, erysipelas, and herpes. In chronic ophthalmia, especially in those cases which involve the eyelids, the sulphate of copper and the nitrate of silver are the best applications: both owe their efficacy to the combination of stimulant and astringent powers. The influence of the solution of nitrate of silver in erysipelas, in the proportion of ʒi to f℥i of distilled water, acidulated with m. viii of diluted nitric acid, pencilled over the whole of the reddened surface, may be regarded almost as a specific in checking the progress of the eruption, and is one of the most important auxiliaries to the general treatment of the disease which modern practice has introduced. I have had occasion to order the greater part of the body to be pencilled with this solution, and have never been disappointed in my anticipations of benefit from its employment.

Astringents have been found beneficial in curing the tendency to inguinal hernia in infants: a strong decoction of oak-bark, applied as a poultice, is the Astringent to be preferred in such cases.

In some instances, when the vital energy is low, the application of Astringents operates on the living solids nearly in the same manner as on the dead or inanimate animal matter. This is the mode in which they destroy warts and polypi: these excrescenses are as it were tanned; they then become the same as a mortified or a dead part, and they are consequently thrown off by the activity of the healthy parts in which they are formed.

Upon the whole, Astringents form a valuable class of remedial agents; and, in many conditions of the body, they present the means of sustaining life under circumstances of the most hazardous description.

SECTION IX.

EMETICS.—MEDICAMENTA EMETICA.

Syn.—Vomitoria.

Emetics are substances which cause the ejectment of the contents of the stomach by the mouth, independent of the stimulus of quantity, or the influence of any nauseous odour or taste. How is this effected?

When some substances are taken into the stomach in a certain quantity, if they be of an acrid nature, they cause an almost immediate antiperistalic action of the stomach and œsophagus, which is rapidly followed by the action also of the diaphragm and those abdominal muscles which promote vomiting; and thus the stomach is instantly emptied. In such cases, a second act of vomiting rarely occurs. Other substances, when swallowed, do *not* immediately operate: the stomach for a short time remains undisturbed. As they begin to exert their influence, an uneasy sensation is felt at the præcordia, which increases and terminates in vomiting. But the influence of the emetic substance, even before vomiting commences, is not altogether confined to the stomach: as soon as the nausea is first felt, the countenance becomes pale, the pulse sinks in power, but beats quicker and more irregularly than before; anxiety, listlessness, depression of spirits, and a tendency to fainting, supervene; at length, sweating succeeds, and, just before the first effort of vomiting, a peculiar sensation of fulness at the clavicles is experienced. After the vomiting has taken place, the face flushes; the pulse, yet feeble, is accelerated, and this continues between each effort of vomiting, which occurs at short intervals. When vomiting finally ceases, the nausea subsides, leaving merely a transitory feeling of depression, which makes the patient indifferent to every thing about him. Such are the phenomena attending the operation of an emetic. In order to understand their theory, the general functions of the stomach must be briefly stated.

The nerves with which the stomach is supplied are derived

from the par vagum and the great solar plexus; but, except at the cardiac portion, the stomach is not an organ of much sensibility. It possesses a kind of peristaltic movement, by which the chyme, or food, changed by its digestive function, is carried forward, from the fundus to the pyloric orifice, through which it passes into the duodenum.

In the act of deglutition, the tongue, the muscles of the anterior and posterior palatine arches, the superior muscles of the soft palate, and the constrictors of the pharynx, are all in action; and the pharynx is elevated to receive the food: and I mention this particularly, because the same elevation of this portion of the gullet takes place in the act of vomiting; and, as in swallowing, the glottis is also closed at that time. Both these parts remain in this state during the act of retching, until the ejectment of the contents of the stomach is effected, when the pharynx again falls, the glottis is opened, and a full inspiration is effected.

When the food is pushed forwards from the fundus of the stomach to the pylorus, it operates as a healthy excitant to the nerves of the organ; and the action of the pylorus responding to that of the rest of the stomach, it opens, and the chyme passes into the duodenum. But, if the food be imperfectly digested, and if, before complete chymification, it be carried forward to the pylorus, that part of the stomach does not concur in this action of the fundus; its orifice is more firmly closed; its muscular fibres are thrown into a kind of spasmodic action; and the imperfect chyme is suddenly and forcibly thrown backwards, by an inverted action of the part; and it again falls into the fundus of the stomach. Sometimes, however, it rises into the œsophagus, exciting eructation, and is returned into the mouth. This repulsion of undigested food, by the pylorus, depends on the distinct influence of a *natural* and an *unnatural* stimulus applied to the same part. The perfectly digested chyme affords the natural stimulus; and the action in the pyloric portion of the stomach, excited by it, is preceded by the opening of its valvular orifice; but when the chymification is imperfect, or when unusual substances stimulate this region of the organ, no opening of the pylorus takes place, and an antiperistaltic movement of the viscus is the result.

In a healthy condition of the stomach, we are not sensible of its action; but any morbid or unusual irritation causes an uneasy feeling, if not pain; hence the origin of that sensation which, independent of the nausea, precedes vomiting.

Stimulants which excite the muscular fibres of the stomach are not directly applied to them, but to the contiguous coats; between which, however, and the muscular fibres there is the closest sympathy. When some kinds of Emetics are received into the stomach, they operate, as already stated, by their local in-

fluence; for any strong irritation of the œsophagus, or the stomach, or even of the intestines, will cause immediate vomiting: but when some other substances are taken, a certain time elapses before they cause vomiting; and it has been proved that the emetic substance is taken into the circulation before the vomiting is induced. This is the opinion of Majendie, who demonstrated that when vomiting is caused by an emetic substance, it can be stopped by pressure on the medulla oblongata; but this opinion has been objected to by Müller. He says that the Emetic causes a local irritation of the stomach, that is propagated by sympathy to the abdominal muscles and the diaphragm, which are excited to action, and vomiting is the result; or, in other words, that vomiting is the result of nervous sympathy, communicated to the brain, through the splanchnic and sympathetic nerves. Now, although this statement of Müller explains the action of direct Emetics, which operate the moment they enter the stomach, yet it does not account for the time which intervenes between taking some Emetics and the act of vomiting. Neither is it consistent with the fact, that large doses of tartar-emetic cease to cause vomiting after the second dose. The topical influence in this case prevents absorption, and consequently vomiting is not induced. I am, therefore, still of opinion that the action of some emetics is not owing to a local stimulus on the extremities of the nerves of the stomach, but to the action of the absorbed Emetic, as a substance *ultra naturam*, operating on the nervous centres, causing unusual and inverted contractions of the stomach and the muscles concerned in the act of vomiting. The nerves chiefly affected are a branch of the *eighth* pair, the *intercostal*, and the *phrenic* nerves. This opinion does not interfere with the fact, that the irritation of certain nerves will cause vomiting; for example, that of the vagus in the pharynx, when it is mechanically irritated.

Vomiting may be induced by a variety of causes:

1. It may occur from the food undergoing changes different from those of healthy digestion: from mechanical irritants in the stomach: from tumors pressing on the pylorus: from inverted actions of the intestinal canal, forcing bile and other contents of the duodenum into the stomach: from any substance, even the mildest, entering the stomach, when inflammation of the organ is present, augmenting its nervous irritability: and, lastly, from emetic substances introduced into it.

2. Vomiting may be *indirectly* induced by strangulations of the intestines; by the irritation in the passing of biliary or renal calculi; by titillation of the fauces; by the division of the optic nerve in the extirpation of the eye; by inflammation of certain portions of the brain or its coats; by the repulsion of cutaneous eruptions; by emetic substances injected into the veins; by sailing, swinging, riding in a carriage, and some other

movements; by pregnancy; by the influence of certain odours; and even by some mental impressions. Whichever of these causes excites vomiting, a specific action of the stomach and the consent of certain muscles of the thorax and the abdomen are necessary to produce the effect: hence arises the question, in what manner is vomiting effected? Bayle and Chirac suggested the idea that the stomach is passive during vomiting; and they contended that this action is affected solely by the diaphragm and the abdominal muscles*; an opinion which was afterwards maintained by Duverney, Senac, and John Hunter: and which was endeavoured to be refuted by Haller; but again more recently brought forward by Majendie†. Mr. Litre, also, denied the influence of the abdominal muscles, and maintained that the diaphragm is the sole agent in producing vomiting; and, with Lieutaud as well as Haller, he supported the idea that the stomach is the chief agent. Haller founded his opinion on having observed, in a patient who could not be made to vomit by the most powerful Emetics, that the stomach was greatly distended and insensible. Sir Charles Bell held, with some modifications, nearly similar opinions to those of Lieutaud upon this subject. "That vomiting," said he, "may be produced by the inverted motion of the stomach and œsophagus, is apparent from experiments on living animals, where the abdominal muscles are laid open from cases in which the stomach has rested on the thorax, and yet been excited to active vomiting." He also states that the walls of a stomach in his possession "had become so thick that they could no longer suffer contraction by the muscular fibres; the consequence of which was, that, although the inner coat of the stomach was in a raw and ulcerated state, there was no active vomiting." Sir Charles, however, modifies this opinion, by remarking, "that when the stomach is excited to vomiting, there is consent of the abdominal muscles, by which they are brought into violent spasmodic action; not alternating, as in the motion of respiration, but acting synchronously, so as greatly to assist in compressing the stomach; but," adds he, "at the same time, the action of these muscles, however forcible, cannot alone cause vomiting; nor has this action any tendency to produce such an effect on other occasions, in which the utmost contraction of the diaphragm and abdominal muscles is required for the compression of the viscera." M. Majendie, in his Memoir, published in 1813, endeavours to refer this operation solely to the influence of the diaphragm and abdominal muscles; and thus supports the opinion of Bayle and Chirac. In one of his experiments, he drew the stomach through an opening in the

* Histoire de l'Academie de Sciences, 1686.

† Mem concernant l'Influence de L'Emetique, &c. Nouv. Bull. de la Soc. Philom. t. iii.

abdomen, thus freeing it from the influence of the diaphragm and the abdominal muscles, and he found that vomiting could not be excited. He also ascertained that, if all the abdominal muscles be removed, leaving the linea alba, vomiting still occurs, from the stomach being pressed, as he supposes, between that part and the diaphragm. In one experiment, he substituted a pig's bladder for the stomach, and yet vomiting took place! The division of the phrenic nerve weakens the action of vomiting; but does not altogether prevent it. These experiments prove: 1. That the influence of the nervous system is essential for the production of vomiting. 2. That the abdominal muscles influence the ejectment of the contents of the stomach; and this is also the case with the diaphragm. But Maingault found that vomiting occurred when both the diaphragm and the abdominal muscles had been divided: the Academy of Paris, however, found vomiting could not take place with external pressure on the stomach. Dr. Richard Harrison, in his Gulstonian Lecture, adopted the opinion of Chirac and Majendie, respecting the influence of the diaphragm and the abdominal muscles in vomiting; but he adds to those muscles the contraction of the stomach itself. Dr. Marshall Hall* has endeavoured to prove that Majendie's opinion of the influence of the diaphragm is incorrect; and that the act of vomiting is, in fact, a forcible expiratory effort. He contends that, if the diaphragm contract, the act of vomiting would be attended with inspiration; that the glottis, in this case, would be necessarily open, and that the fluids ejected from the stomach would enter the larynx, and induce great irritation there, an event which does not occur in vomiting. Dr. Hall's theory is, that "the contents of the thorax and the abdomen are subjected to the sudden and almost spasmodic contraction of all the muscles of expiration, the larynx being closed so that no air can escape from the chest, and the two cavities being made one by the floating or inert condition of the diaphragm." The mechanism of vomiting, therefore, according to Dr. Hall, "differs little from that of coughing, by which, indeed, the contents of the stomach are frequently expelled; the larynx in the former is, however, *permanently*, in the latter only *momentarily*, closed; and there is doubtless a different condition of the cardiac orifice and of the œsophagus." In order to confirm his opinion, Dr. Hall made an opening in the trachea of a dog, who was excited to vomit by subsulphate of mercury. During the act of vomiting, the air was forcibly driven from the lungs through the artificial opening. Dr. Hall admits the influence of the œsophagus, and adds: "it is plain that the cardiac orifice must be freely opened; for *mere pressure* upon the viscera of the abdomen will not, in ordinary circumstances, evacuate the contents of the

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* Mem. on the Nervous System.

stomach. To effect this open state of the cardiac orifice, it is probably requisite that the diaphragm should indeed be in a relaxed rather than in a contracted state." Ingenious as this theory is, still it does not explain the mechanical operation of vomiting well; and I am, therefore, induced to advance a new opinion, which, however, is, in some degree, a modification of that of Dr. Hall.

We must admit that, during the act of vomiting, the glottis is closed, and that a powerful effort is made, similar to that of expiration; whilst there is a sudden contraction of the abdominal muscles, forcing up the whole of the contents of the abdomen towards the thorax; but the diaphragm is fixed, owing to the closing of the glottis, and the retention of the quantity of air which the lungs contained at the commencement of the efforts. The diaphragm is thus prevented from ascending into the chest; and the pharynx being drawn up, as in the act of deglutition, opens the cardiac orifice, and forms with the stomach one continuous cavity. In this state of things, on the sudden compression of the stomach, by the abdominal muscles drawn forcibly inwards, the diaphragm being fixed, the contents of the stomach are directed upwards, with a degree of force commensurate to the suddenness of the pressure upon its walls, and they are thus ejected by the mouth. If this description be correct, it is evident that the act of vomiting is the result of the sudden simultaneous action of the abdominal muscles and the diaphragm, as well as all the muscles of expiration, at a moment when the glottis is closed and offers resistance to the ascent of the diaphragm. The stomach is passive; and most probably the contraction of that organ forms no constituent in the process. Indeed, were the stomach not passive, its contraction would diminish the impulse of the abdominal muscles upon it, and its contents would not be expelled in the sudden and forcible manner which occurs in vomiting.

Such is my view of the operation; but, in whatever manner vomiting is accomplished, it is dependent on the condition of the nervous system. Dr. Paris remarks, "that, however forcibly the stomach may be goaded by emetics, when the energy of the nervous system is suspended, as in cases of profound intoxication, or in violent wounds and contusions of the head, 'vomiting will not take place',—while, if the brain be only partially influenced; as by incipient intoxication, or by a less violent blow upon the head, its irritability is increased instead of being paralyzed, and vomiting, under such circumstances, is excited by the slightest causes."

As, in the act of vomiting, all the abdominal viscera are compressed, the blood is consequently more forcibly propelled through them, and the secretion of the fluids is thereby increased and mo-

dified. This is especially the case in the portal system, so that the secretion of bile is both augmented in quantity and altered in quality; the gall bladder and the biliary ducts are emptied; the pancreas and the spleen are similarly affected; and even the kidneys are influenced, and the urine increased in quantity.

The pulmonary system shares the influence of the act of vomiting, and the circulation through the lungs is thereby accelerated. The secreting and exhalant vessels of the lungs are also excited; consequently emetics hold a place among the tribe of expectorants.

Upon the stomach itself, Emetics produce a change, and alter the secreting fluids. Sometimes those ejected are so acrid as to excoriate the fauces: occasionally they are as black as ink; at other times they are yellow, glutinous, and of every consistence. These appear after the contents of the stomach have been ejected; they are the result of the irritant action of the Emetic upon the coats of the stomach, and are secreted almost at the moment of their ejectment.

Emetics influence the general system. They stimulate, generally, the heart and arteries; the blood, during the act of vomiting, being propelled more quickly through the arteries, and returned with greater rapidity by the veins: hence it is more equally diffused over the body, and local determinations and congestions are removed.

Emetics act as general evacuants, by augmenting the excretion of fluids from the intestinal exhalants, and depletion is favoured. The impulse, also, which they communicate to the capillaries, preventing the deposition of fluids, and the removal of those already deposited, enable them to aid the cure of dropsies. In consequence of the law of the system, that all excitation is followed by collapse, Emetics cause a sudorific effect; and, by abating the force of the circulation, they are also useful in active hæmorrhages.

The substances employed as Emetics differ in the time required for their operations. The sulphates of zinc and of copper operate almost as soon as they are swallowed; tartar emetic acts less rapidly; and the vegetable emetic substances require a still longer time for their operation. Tartar emetic operates more quickly than ipecacuanha, and even than emetia, its active principle. This difference in point of time is not satisfactorily explained; for substances in a state of solution display the same difference. Thus, a solution of tartar-emetic operates sooner than a solution of emetia; and this is the case, also, when the former is taken in powder, and the latter is in its state of combination in the powder of ipecacuanha. The only probable cause is the greater facility of absorption of the tartar emetic than of the emetia. But although we cannot explain this circumstance,

yet the time required by different emetic substances should be known by practitioners, since much of the advantage expected from this group of medicines depends upon the period of their action.

Emetics differ in power: the *saline* operate more violently than the *vegetable;* but the vegetable cause *more* severe nausea and maintain it *longer* than the saline. The first impression of the saline Emetics on the nervous system is more energetic than that of the vegetable; they are more readily decomposed, and they are more quickly thrown out of the system than the vegetable.

Some precautions are requisite in the administration of Emetics. Persons of torpid habits are more difficult to vomit than those of irritable habits: they require larger doses, and, sometimes, the largest doses of Emetics will not be followed by vomiting; when this occurs, much uneasiness is produced. Sanguine persons are more easily affected by Emetics than melancholic persons; women, in general, than men; children than adults.

As, during the act of vomiting, pressure is necessarily applied to the descending aorta, and there is, consequently, a temporary interruption of the pulmonary circulation, and the blood is returned with difficulty from the head, vomiting should not be excited in those who are predisposed to *apoplexy*. From pressure also upon the abdominal viscera, Emetics should not be administered to those who are predisposed to *hernia*, or prolapsus of the *anus*, or of the *uterus;* nor are they always safe in *advanced* pregnancy.

With respect to the period of the day for the administration of Emetics, we must be guided by the circumstances of the case which demand their employment. If the urgency is not immediate, the evening is the best time, as it enables sleep to be indulged, so as to relieve the exhaustion caused by the action of the Emetic.

It is customary to give warm water during the operation of an Emetic. This promotes its action, if the water be drank after each time of vomiting; but too much should not be given at a time; for the stomach, when overloaded with fluid, is oppressed, and does not respond to the action of the abdominal muscles, but suffers greatly from straining; and, if it be in a state of previous disease, it is in danger of laceration. The quantity of fluid for an adult should not exceed two-thirds of a pint for a draught; the fluid should be tepid, and when the stomach is weak, some bitter infusion should be added, to aid the action of the emetic. If the vomiting be severe and long continued, it may be moderated and checked by solutions of neutral salts, especially acidulated sulphate of magnesia; or citrate of potassa in a state of effervescence; or a teaspoonful of magnesia in a glass of sherry wine; or by solid opium administered in small doses;

or by the cautious administration of a few drops of hydrocyanic acid; or of Creosote.

Emetic substances, given in excess, sometimes cause singular consequences: thus, inflammation of the extremities, terminating in gangrene, has followed their use. The following case is illustrative of this effect:—"A woman of a costive habit of body had unsuccessfully employed many means of purging herself: a surgeon, to whom she applied, administered a violent remedy, which operated both upwards and downwards. Cramps, convulsions of the extremities, and extreme anguish supervened. Immediately afterwards, she was attacked with severe lancinating pains of the extremities; and ecchymoses appeared on different parts of the body. Gangrene attacked the cartilaginous part of the nose; the lower lip; the skin of the chin; the points of two toes on the right foot, and the great toe of the left foot: all of which successively dropped off*." M. Barbier, who quotes the above case, relates the following, which came under his own notice:—"A woman of the Fauxbourg d'Amiens, having received a purgative remedy from an herborist, was attacked, after taking it, with incessant vomiting and purging, which rapidly reduced her strength: she was carried to the Hotel-Dieu: next day the point of the nose, the ears, and the cheeks became of deep violet hue; and soon afterwards the same colour spread over the feet and the hands; and gangrene rapidly attacked all these parts: she lost one of her feet, and several toes of the other foot†."

All substances employed to produce vomiting may be ranged under two heads—*Direct Emetics* and *Indirect Emetics*.

Direct Emetics may be defined "substances which produce vomiting by an immediate impression on the nerves of the stomach." It may be asked—how can any direct action upon the stomach produce vomiting, if the stomach be a passive agent in this operation? I reply that, by the term passive agent, I do not mean to assert that the stomach is perfectly inert and insensible to the stimulus of all emetic substances; on the contrary, all irritants, whether chemical or mechanical, are capable of exciting the stomach to vomiting; but, nevertheless, in this operation, the stomach is not the active agent. This seeming inconsistency may be thus explained. When the stomach is in the performance of its natural function, the digested food is pushed forward to the pyloric orifice; but, if the chymification be not complete, it is again thrown back into the fundus; and, occasionally, even into the pharynx, producing eructation—a circumstance, however, which occurs only when the secreted

* Journal de Médécine, tome xxxviii.

† Traité Elémentaire de Mat. Médicale, par J. B. G. Barbier, t. iii, p. 328.

juices of the stomach are in a morbid state; and, under this condition, the ejectment of the food is produced by circumstances resembling, in every thing but degree, that produced by Emetics. In a similar manner, when a large dose of sulphate of zinc or sulphate of copper, for instance, is swallowed, its immediate application to the nerves of the fundus of the stomach produces a spasmodic contraction, which throws the whole contents of the viscus, mixed with the sulphate, upon the pylorus; but these are as rapidly returned, even before the relaxation, which must follow the spasmodic contraction, have taken place; and by this means the emetic substance, being applied to the nerves of the cardiac portion of the stomach, the muscles and every other part necessary for effecting vomiting are simultaneously called into operation, and vomiting takes place.

The suddenness with which direct Emetics operate is no argument against the truth of this explanation, which I offer as the only theory that, in my opinion, is capable of explaining the immediate influence of sulphate of zinc, sulphate or acetate of copper, carbonate of ammonia, and all other matters which cause immediate vomiting. These substances, when taken into the stomach, first hasten that action of the organ which carries the food forward to the pylorus; and there operating, *contra naturam*, instead of opening the pyloric valve, they cause it to shut, and are thrown back upon the cardiac portion, the nerves of which, being suddenly impressed, call into play all those sympathies which operate to produce the action of vomiting. This theory may be applied to explain not only the vomitings which powerful irritants produce when swallowed, but those also that occur in cancerous affections of the pylorus, and those which attend the early stages of pregnancy. In cancer of the pylorus, when food is taken into the stomach, no vomiting occurs until it is pushed forward to the pylorus, which, being morbidly excitable, throws it back, mixed with acrid matters, the result of the disease, which, acting on the extremities of the eighth pair of nerves, spread on the cardiac portion of the stomach; the muscles of the abdomen and those of respiration are instantly called into action to relieve the stomach of the offending matter. During the early stage of pregnancy, again, the sympathy between the stomach and the uterus is such, that the disturbance of the former is in the direct ratio of the energy of the latter; digestion, therefore, becomes depraved; the chyme is imperfectly formed, and, being mixed with the acrid secretion of the stomach, is thrown back from the pylorus, and vomiting is necessarily excited. Substances that act in this manner scarcely enter the stomach ere they are ejected from it: they constitute *Direct Emetics*. Their operation is neither preceded nor followed by nausea. They are adapted for producing full and immediate vomiting in those conditions of the habit in which the exhaustion

caused by nausea would be injurious, but in which it is nevertheless necessary to unload the stomach. They are also most useful in cases of poisoning, not only on account of the rapidity of their operation, but from their action not being followed by absorption, which in such cases would prove highly prejudicial.

2. *Indirect Emetics* are substances which enter the circulation previous to vomiting being excited: and, on this account, a certain space of time elapses after they are taken into the stomach before vomiting ensues. Their influence is directed to the stomach, even when they are injected into the veins. They consist both of organic products and inorganic substances. Indeed, whatever disturbs the energy of the brain to a degree sufficient to affect the stomach by nervous sympathy, and call into action the muscles necessary to establish the act of vomiting, may be regarded as an *indirect* Emetic. Thus, the mechanical irritation of the uvula with a feather or the finger; the motion of a carriage; swinging; whirling; sailing; and many narcotics; produce nausea and vomiting: and the same effects result from the inhaling of some gases.

TABLE OF EMETICS.

A. DIRECT EMETICS.

a.—Ammoniæ Sesquicarbonas.
b.—Sulphate of Zinc.
c.—Sulphate of Copper.

B. INDIRECT EMETICS.

* *Organic Products.*

a.—Acrid Principle, in			
Ranunculus *flammula.*	13.	6.	Ranunculaceæ.
* Hura *crepitans*	11.	13.	Euphorbiaceæ.
* Pedilanthus *tithymaloides.*	—	—	———
* Baptissia *tinctoria.*	10.	1.	Leguminosæ.
* Clitoria *Ternatea.*	—	—	———
* Plumbago *Europæa.*	5.	1.	Plumbaginaceæ.
* Erythronium *Americanum.*	6.	1.	Liliaceæ.
b.—Acrid Volatile Oil, in			
Sinapis *nigra.*	15.	2.	Cruciferæ.
Anthemis *nobilis.*	19.	2.	Asteraceæ.
c.—Cytisina, in			
Asarum *Europæum.*	11.	1.	Aristolochiaceæ.

d.—Emetia, in the roots of			
Cephaëlis *Ipecacuanha.*	5.	1.	Cinchonaceæ.
* Psychotria *emetica.*	—	—	———
* Richardsonia *Brasiliensis.*	—	—	———
* ——— *rosea.*	—	—	———
* Ionidium *Ipecacuanha.*	5.	1.	Violaceæ.
* ——— *Poaya.*	—	—	———
* ——— *parviflorum.*	—	—	———
* ——— *Urticæfolium.*	—	—	———
* Palicourea *crocea.*	5.	1.	Cinchonaceæ.
* Geophila *reniformis.*	—	—	———
* Borreria *ferruginea.*	4.	1.	———
* Sarcostema *glaucum.*			Asclepiadaceæ.
e.—Scillitina, in the bulb of			
Scilla *maritima.*	6.	1.	Asphodeleæ.
f.—Nicotina, in the leaves of			
Nicotiana *Tabacum.*	5.	1.	Solanaceæ.

* * *Inorganic Substances.*

a.—Hydrosulphuret of Ammonia.
b.—Salts of Antimony.

DIRECT EMETICS.

* *Inorganic Products.*

a. Carbonate of Ammonia. *Ammoniæ Sesquicarbonas.* L. *Ammoniæ Carbonas.* E. D.—This preparation has been already described (p. 188). If ʒss to ʒi in solution be administered in a cupful of cold water, and the same quantity of tepid water be swallowed immediately afterwards, vomiting will be instantly excited. In smaller doses, and very largely diluted, it may be used to quicken the operation of other Emetics. In larger doses, it operates as an irritant poison, causing inflammation of the mucous membrane. Among other recorded cases of the fatal effects of the improper use of Carbonate of Ammonia, Huxham mentions that of a young man who had acquired the habit of chewing the solid Carbonate. It produced hæmorrhage from the gums, nose, and intestines: his teeth dropped out; hectic ensued; and, although he discontinued chewing the poison, yet he died of extreme exhaustion, after lingering for several months. When the Carbonate has been taken by mistake, or in an over-dose, the best antidote, if immediately administered, is vinegar.

As an Emetic, Carbonate of Ammonia has been found serviceable in those stages of chronic catarrh, in greatly debilitated habits, in which expectorants cannot with propriety be administered. In such a condition of the system, vomiting aids in unloading

the bronchial tubes: at the same time, the Ammonia affords a salutary stimulus to the nervous system; and the expectoration is restored. In the variety of phthisis, distinguished by the term asthmatic, Ammonia as an Emetic has also proved useful.

b. SULPHATE OF ZINC. *Zinci Sulphas.* L. E. D.—(p. 582.) This is a powerful and certain direct Emetic, more safe than Ammonia, and equally energetic. The emetic influence of Sulphate of Zinc seems to depend on the local irritation which it excites on the nerves of the stomach. It creates no nausea, and operates as soon as it enters the stomach, effecting a single but copious ejectment: it is well adapted for cases of poisoning, and in the commencement of a paroxysm of ague, when we are desirous of breaking the morbid association which keeps up the disease, by giving such an impulse to the system as will propel the blood to the surface and equalize the circulation. In cynanche tonsilaris, when an abscess forms in a situation not readily reached by the knife, and yet not disposed to break, if an Emetic be prescribed merely to burst the abscess, the Sulphate of Zinc is preferable to all other substances. Dr. Marley recommends it strongly, in combination with alum, for pulmonary oppression and hæmoptysis. He recommends it to be given in doses of six grains, in the morning fasting. He says that it produces vomiting instantaneously, but not violently, leaving the stomach invigorated*. Dr. Senter, Dr. Burton, and Dr. Roberts, severally, bear testimony to its utility as an Emetic in phthisis. It is also an useful Emetic in dyspeptic affections†. The dose to produce full vomiting in an adult, is from gr. xv to ℈ss.

c. d. SULPHATE OF COPPER. (p. 583,4.) *Cupri Sulphas.* L. E. D.—This salt of Copper operates as a powerful direct Emetic, producing vomiting almost as soon as swallowed, without exciting nausea. It has been employed in the incipient stage of phthisis; and it is a curious fact, that in this disease the sulphate will sometimes lie in the stomach for upwards of half an hour without causing vomiting, and then operate at once and as forcibly as when it acts in the usual manner. I cannot pretend to account for this effect. Among other physicians who have prescribed this salt of Copper in phthisis, Dr. Mackittrick Adair held a very sanguine opinion of its salutary influence. He gave first, as an Emetic, a pint of warm water, then a grain of Sulphate of Copper, with a drop of diluted Sulphuric Acid, in half an ounce of water, every other evening for three days, and then every

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* Treatise on Tropical Diseases. London, 1804, p. 557.

† A curious fact regarding this salt is mentioned in the 12th volume of Thomson's Annals of Philosophy. We are informed that a spider fed and was supported on this salt alone for a considerable time. It is, nevertheless, poisonous to man, when given in doses intermediate between the largest administered to produce a tonic effect, and those given to excite vomiting. In large doses, its emetic properties prove the safety of those who take it. The antidotes for poisoning by it are milk, albumen, and the chalk mixture, after the use of the stomach pump.

morning. Although I have had the advantage of considerable experience in treating phthisis with Emetics, yet I cannot recommend that the Sulphate of Copper should be administered. Before the use of the stomach pump, that salt of Copper was very frequently employed in cases of poisoning by opium and other narcotics, when the Sulphate of Zinc failed to rouse the stomach into action; and it is only under such circumstances that it is advisable to use it. The dose is from ten to fifteen grains, dissolved in three fluid ounces of water.

In cases of poisoning by the salts of Copper, after the stomach pump has been used, the best antidotes are milk, albumen, and ferrocyanate of potassa. In using the stomach pump, milk and water might be substituted for simple water.

INDIRECT EMETICS.

* *Organic Products.*

a. Acrid Principle, or Oil. The acrid principle of the following substance is not contained in the seed, but developed by the influence of water.

b. Flour of Mustard. *Sinapis.* L. *Sinapi.* E. (see p. 90.) *Sinapis Semina.* D.—This Acrid Oil or Principle, developed by water in flour of Mustard, is powerfully excitant, and to its impression on the nerves of the stomach must be attributed the emetic influence of Mustard. It operates quickly; and, from the powerful excitement which it induces on the vascular system, there is reason for supposing that the acrid principle is partly taken into the circulation; and hence, that the act of vomiting is not solely the result of its direct impression on the gastric nerves.

Mustard is a useful Emetic in cases of intoxication threatening apoplexy; and in Cholera *asphyxia*, in which its excitant property proves beneficial after its emetic operation is over. In atonic gout, also, in which no irritation is more hurtful than that arising from crude, undigested matters in the stomach, a mustard emetic proves highly useful. If the flour of Mustard be genuine, a dessert-spoonful, about two drachms, mixed in f℥vi of water, will be found the dose for an adult.

c. Chamomile Flowers. *Anthemis.* L. E. *Flores Chamæmeli.* D.—A strong tepid infusion of these flowers, administered in doses of from f℥iii to f℥iv, operates as a powerful Emetic, and is well fitted for dyspeptic affections. A weaker infusion is a useful diluent in promoting the operation of other Emetics, when the stomach is weak and likely to be too much oppressed by the use of simple water.

d. EMETINA, OR EMETA.

This substance was discovered by M. Pelletier in 1817. It is procured by treating the powdered root of ipecacuanha with Ether to remove an odoriferous oil, then exhausting the residue

with boiling rectified spirit, after distilling off some of the spirit; what remains, after being acted upon by magnesia, which forms a precipitate that should be well washed, is to be treated with boiling rectified spirit (part of which may be saved by distillation), and the residue combined with a very dilute acid. This process is several times repeated before the emeta is procured. It forms in brown semitransparent scales, having an odour resembling caromel, and a bitter, slightly acrid taste. It attracts moisture of the air, and is consequently deliquescent.

In order to obtain pure Emeta, calcined magnesia must be used, and the mixture boiled. The precipitate is then washed in the filter with cold water, dried, reduced to powder, and acted on by strong alcohol. The emeta thus procured is next to be decoloured by pure animal charcoal, and the filtered solution again acted upon by calcined magnesia. The precipitate being dried and powdered and treated by alcohol, the Emeta is obtained from the alcoholic solution by careful evaporation. In its pure state, it is white, pulverulent, unalterable in the air, scarcely soluble in cold water; soluble in alcohol, but not in ether. Its taste is slightly bitter; it displays an alkaline reaction, and forms with acids neutral salts, which, however, are little disposed to crystallize. Its taste is slightly bitter. It closely resembles uncrystallized narcotina; but the solubility of the latter in ether readily distinguishes it. According to Dumas and Pelletier, it consists of

Carbon	64·57	or 35 eq.	194·20
Hydrogen	7·77	25	= 25
Oxygen	22·95	9	= 72
Nitrogen	4·00	1	= 14·15
	99·29	equiv.	305·35
Loss	71		
	100·00*		

Sulphuric acid carbonizes and destroys Emeta: nitric acid changes its colour to a deep red, then to yellow; much nitrous gas is evolved; and the Emeta is converted into oxalic acid. Hydrochloric, phosphoric, oxalic, tartaric, and acetic acids, dissolve it without altering it: gallic acid precipitates it from its solutions, either in water or in alcohol, and forms with it an insoluble, inert compound. The tincture of galls, owing to the presence of tannic acid, precipitates it with more energy than gallic acid. The tincture of iodine also throws down a precipitate in the solution of Emeta, the nature of which is not well understood. It is completely precipitated by diacetate of lead: the precipitation with the acetate is less complete; the acetic acid opposing itself to the precipitation. It is also slightly precipitated

* Annales de Chim. et Phys. t. xxiv, p. 181.

by the protro-nitrate of mercury, the bichloride of mercury, and the chloride of tin. The effects of these reagents are sufficient to characterize Emeta as a vegetable principle, sui generis.

When given in doses of from a grain to three grains, Emeta produces full vomiting; and, as none of the other principles of Ipecacuanha root produces this effect, there is no doubt that its emetic power is owing to this substance. It is also contained in the roots of some other plants besides those of Ipecacuanha.

There are three kinds of Ipecacuanha known in commerce; the *brown*, the *grey*, and the *white;* but they may be, with more propriety, regarded as of two kinds, *annulated* and *striated.* Of the first kind there are three varieties, the *brown*, the *grey*, and the *red.* I shall treat of each in its order.

1. *Annulated Ipecacuanha.*

IPECACUANHA ROOT. *Ipecacuanhæ.* L. E. *Cephaëlis Ipecacuanha Radix.* D.—This is *brown* Ipecacuanha. Before describing it, I may remark that De Candolle's explanation of the word Ipecacuanha, which he says implies *vomiting root*, is incorrect. The two first syllables, *ipe*, is the Peruvian word for *root*, and Cacuanha the name of the district where it was first procured; so that the name simply means the *root of Cacuanha:* but under this name very different roots are designated, all of them possessing the property of exciting vomiting. The Cephaëlis *Ipecacuanha* is a perennial, a native of the Brazils and New Grenada, and belongs to the Natural Order Cinchonaceæ. Ipecacuanha root was introduced into Europe, as an Emetic, towards the middle of the seventeenth century; but so little was known of the plant which yielded it, that Ray believed it was the root of a species of *Paris;* Morison and Linnæus, that of a species of *Lonicera*, or honeysuckle. At length, in the commencement of the present century, M. Brotera, professor of botany in the University of Coimbra, in Portugal, published, in the Transactions of the Linnæan Society of London, for 1800, a description of the plant, and figured it under the name Callicocca *Ipecacuanha.* De Candolle* afterwards examined it, and ascertained that it belonged to the genus Cephaëlis, and gave it the specific name of the Peruvians, *Ipecacuanha*†. It is a small plant, scarcely ever rising more than two or three feet in height, often lying on the ground, and rooting at the joints. It is cultivated, according to Humboldt, in Badillas in New Granada; the leaves are opposite, oblong, ovate, hairy, on short downy petioles; stipules erect, appressed, membranous. The flowers are capitate, bracteated, white, funnel-shaped, downy on the exterior, limb

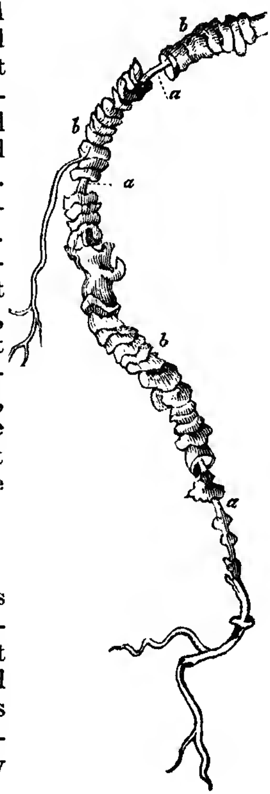
* See his Memoir, published in 1802.

† Woodville's Med. Bot. third edition, vol. v, p. 14. London Dispensatory, art. Cephaëlis. Richard, Hist. Nat. et Med. des differentes Espèces d'Ipecacuanha, 1820. Hayne, viii, 20. Martius, Spec. Mat. Med., Brasil. v, t. 1. Lindley, 442.

shorter than the tube, with five ovate reflexed segments. Fruit, an ovate berry. The *roots* are creeping and horizontal, representing threads strung with small tubercles or rings, closely pressed together. The cuticle is brown, with a white parenchyma beneath it, and, in the centre, a filiform woody axis. The roots are termed *Raicilla* in the places where the plant grows.

A very vague and imperfect description of this plant was given by Margrave and Piso, in their History of the Brazils, published in the sixteenth century: and the plant was unknown to European botanists until a dried specimen was sent, in 1764, by Mutis to the younger Linnæus, who described it under the name of Psychotria *emetica**. But the most satisfactory information has been communicated by Dr. Martius, who travelled in the Brazils under the auspices of the King of Bavaria.

The root of *annulated* Ipecacuanha (see cut) is seldom so thick as a goose-quill; is unequally and irregularly knotted and branched; and is covered with a brown epidermis. It consists of two parts: *a*, an *inert*, ligneous axis; and *b*, an *active*, cortical portion. The fracture is brownish and resinous; yet the root contains no resin. The taste is bitterish, acrid, and nauseous; the odour faint and herbaceous. In one thing this species is distinguishable from all the others, namely, the root is not a continuation of the underground, horizontal stem, but offsets from that part of the stem. This species of Cephaëlis supplies what is termed *brown*, *grey*, and *red Ipecacuanha*, which were long considered as the roots of distinct species of Cephaëlis; but they are those of mere varieties of the same plant.



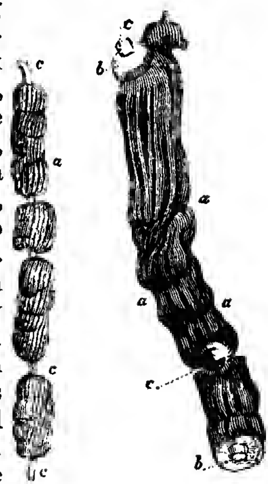
2. *Striated Ipecacuanha.*

The *striated* Ipecacuanha, which is the root of a distinct genus, the Psychotria *emetica*†, is now seldom brought to Europe, although it is more employed in Peru than the root of the Cephaëlis *Ipecacuanha*. The genus Psychotria resembles the Cephaëlis, yet it sufficiently differs to constitute it a distinct genus.

* This plant was then erroneously supposed to yield the true Ipecacuanha.
† Plant, Æquin—Humboldt & Bonp. ii, 142. Lindley, 440.

The Psychotria *emetica* is a small under-shrub, found in Peru and New Grenada; the root is nearly horizontal, as thick as a swan's quill, jointed at irregular distances, and furnished with a few fibrous radicles: but it is not knotted like that of the Cephaëlis: it is a little branched, and smooth.

Striated Ipecacuanha (see cut), differs from the ordinary or annulated Ipecacuanha in the cylindrical form of the root, which, instead of the rings, present strangulations, *a, a, a,* at moderated distances, with the intervening spaces striated. The cuticle has a reddish-brown colour, the cortical part, *b*, is dark coloured, especially when moistened, and the woody axis, *c*, is white. The root breaks with a brown or blackish, scarcely resinous, fracture; impresses a feeble taste of pepper when long chewed, but has no bitterness, and almost no odour. According to the analysis of M. Pelletier, 100 parts of this root furnish nine only of Emeta; twelve of fatty matter, with a large proportion of gum and fecula; and traces of gallic acid. On this account, it is considerably less active than the root of Cephaëlis; and consequently is little employed, even in France, where it was introduced to the notice of the profession by Merat*.



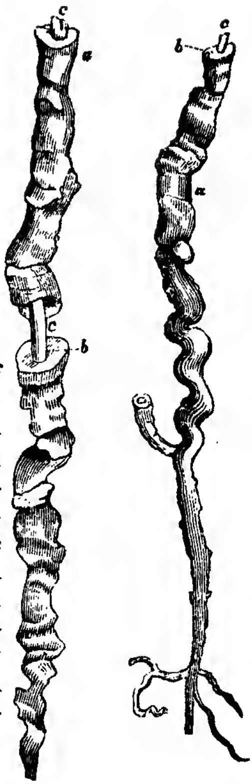
From what has been said, it is perfectly evident, that although these different kinds of roots had been so long regarded as varieties of the same plant, yet even their physical, or natural characters are sufficient to mark their generic difference. Another description of Ipecacuanha has also been occasionally introduced into commerce, under the name of *White Ipecacuanha*. Its characters are too distinct to allow it to be mistaken for either of the kinds already described. It is tortuous, sometimes branched, and occasionally rough; of a pale whitish colour; the odour is nauseous and herbaceous; the taste starchy, insipid, and remarkably acrid: the axis is thicker than the cortical part, and yellow. It is the root of the Richardsonia *Brasiliensis* of Gomez†. Several other roots—as, for instance, those of several species of Viola; in particular, V. *Ipecacuanha*, V. *canina*, and V. *parviflora*, two species of Ionidium; the Cynanchum *Ipecacuanha*, and Euphorbia *gerardiana* — are also used as Ipecacuanha, and mixed with the roots of the Cephaëlis.

The roots of Polygala *Poaya* are also employed as Emetics

* Dictionnaire des Sciences Med. art. Ipecacuanha.

† Virrey, Dict. Sc. Med. vi. 345. Lindley, 444.

in Brazil. The similarity of some of these roots to Cephaëlis Ipecacuanha root is shewn in the opposite cut, copied from a plate of Von Martius*. The nearest figure is the root of a Richardsonia; but of what species Von Martius could not determine: it resembles the root of true Ipecacuanha in its epidermis, *a*, and the annular structure of its bark, *b*, which is also thick in proportion to the centre, *c*. The further figure is the root of Ionidium *parviflorum*; and although it is less annular than the first, yet, from the thread-like aspect of the ligneous axis, *c*, and its cortical part, *b*, it might readily be mistaken for true Ipecacuanha. These roots are unknown in Europe; and neither they nor those of Ionidium *Ipecacuanha*, I. *brevicaule*, I. *urticæfolium*, nor of Richardsonia *emetica*, have been analysed. M. Pelletier examined those of Richardsonia *Brasiliensis*, and procured 6 per cent. of Emeta—a proportion too small to render the root of any value as an Emetic. M. Vauquelin found 9 per cent. of Emeta in Viola *Ipecacuanha*†.



Such are the roots of the various plants which have been used under the name of Ipecacuanha. Those of the Cephaëlis also demand our particular notice. Let us now see what part of this is *active*, and what *inert*.

Various analyses of Ipecacuanha had been made at different periods; but it was not until 1817, when M. Pelletier published his analysis, that any thing satisfactory had been offered upon this point. He ascertained that the active constituent of the Brazilian root is Emeta, which is in the proportion of 16 per cent. in the best specimens of the root: the other components exert no emetic influence, and are 2 per cent. of an odorous, oily, or fatty matter, 6 of wax, 10 of gum, 4 of starch, traces of gallic acid, and 20 woody fibre. The analysis of the ligneous portion afforded 1·15 only of Emeta, and that, perhaps, belonged to some portion of the cortical part imperfectly separated. Hence the propriety of separating the cortical from the ligneous part.

In Ipecacuanha procured from the Psychotria, there are 14

* Specimen, Mat. Med. Brasiliensis, &c. 1824. Tab. 8.
† Journ. de Pharm. Juin 1828.

per cent. of Emeta: in the White Ipecacuanha, only 5 per cent. There are two methods of separating the Emeta; the best is that which I have described.

The soluble substances contained in Ipecacuanha are rendered evident in the aqueous infusion of the powder by reagents: thus, the infusion of galls or tannic acid throws down the Emeta; iodine causes a reddish precipitate, which is a compound of iodine and Emeta: diacetate of lead throws it down in conjunction with the gum: the salts of iron detect traces of tannic acid by deepening the colour; and bichloride of mercury displays the albumen. From these results, it is evident that infusions containing tannic acid should not be ordered in conjunction with Ipecacuanha, neither should Ipecacuanha be prescribed in combination with acetates of lead, the salts of iron, nor iodine*.

Ipecacuanha is exhibited in many forms; at present we have no occasion to notice any but those employed for emetic purposes The powder is the preparation most used as an Emetic: it should be that of the bark; for, as the ligneous fibre is perfectly inert, it should be separated in the pulverization—100 parts of the root should yield 30 of the cortical substance and 20 of the ligneous part. The powder is of a bright grey colour, with a nauseous, disagreeable odour, and a bitter, acrid taste, which adheres to the throat. The dose of the powder, to produce full vomiting, is from ℈i to ʒss. The watery solution is more active than the powder. The full dose, ʒss, is rubbed up with f℥vi of water; ⅙ of it is a dose, which may be repeated at half an hour, if the first do not produce vomiting.

As a medicine to produce vomiting, the first effect of Ipecacuanha on the mucous membrane of the stomach is that of a local irritant; the Emeta is then separated and absorbed, and causes that simultaneous action of the muscles of the abdomen, the thorax, and the diaphragm, which constitutes vomiting. In general it does not cause vomiting till 15 or 20 minutes after it has been swallowed. Sometimes, even in a large dose, it fails to produce vomiting, and acts on the intestinal canal, inducing a slight diarrhœa—a circumstance which can only be attributed to idiosyncracy. In administering it as an Emetic, it may be given with a view of simply unloading the stomach, or of acting sympathetically on more distant organs, after it has performed its emetic action.

When prescribed with the first intention, it frequently operates also on the bowels, owing to some of it being forced beyond the pylorus in the first effort of vomiting; and, on this account,

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* The presence of the starch in the insoluble part in cold water is rendered evident by boiling a portion of this residue in water, and testing it with Iodine.

when added to jalap, the purgative properties of this drug are much augmented. This, however, can be prevented by adding gr. i of tartar-emetic to the dose of Ipecacuanha. Sometimes it determines to the surface after exerting its emetic effect. With regard to the dose of Ipecacuanha requisite to produce full vomiting, I have already stated the quantity for an adult to be from ℈i to ʒss: it is unnecessary to say that this must vary according to the sex and the temperament of the patient. The dose for a young infant is a grain: for children from six to ten years of age, from 8 to 10 grains: and for advanced youth of both sexes, from 12 to 18 grains. Of an infusion made by triturating ʒss of the powder with f℥vi of water, f℥ii, administered at intervals of half an hour, generally cause full vomiting; for children, fʒii of the vinous infusion may be given, and repeated every fifteen minutes until vomiting be produced. A question has been frequently discussed—Is it always indifferent whether Ipecacuanha or tartar-emetic be given as an Emetic? The answer is not difficult. Ipecacuanha is preferable in every instance in which the powers of the stomach are required to be maintained and yet vomiting is indicated; and, in cases in which there exists a chronic diarrhœa, there can be one opinion only as to the superiority of Ipecacuanha over tartar-emetic*.

With respect to the substitution of *Emeta* for Ipecacuanha, M. Majendie made several experiments, the results of which demonstrated that the former acts more quickly than the latter: and that its emetic effect is generally followed by sweating, and a tendency to sleep. It has not been much employed in this country; but the French physicians prefer it to Ipecacuanha. It is ordered in a solution of four or five grains in f℥vi of water, of which f℥ii are ordered to be taken every half-hour until full vomiting be procured. That it operates through the medium of absorption, has been demonstrated by injecting a minute portion of its solution into the jugular vein; into the cavity of the pleura; into the tissue of muscles; and into the anus of a dog. In all these cases vomiting was produced. If Emeta be overdosed, it excites, independent of violent vomiting and purging, the most dangerous, and often fatal, results. The lungs are found gorged with blood, and in a state approaching to hepatization; and the mucous membrane, throughout the whole intestinal canal, exhibiting appearances of inflammation. The powder of the

* The employment of Ipecacuanha as an Emetic was first noticed by Piso, in 1618. A quantity of it was brought to Europe by a physician of the name of Legras, in 1672; but its introduction was opposed, and would have continued to be so, had not a French merchant of the name of Grenier, who transported one hundred and forty pounds of it to Paris in 1686, engaged Adrian Helvetius, a physician of Rheims, to examine its effects. Louis XIV aided Helvetius in introducing it as a remedy in dysentery. Helvetius received £1000 for his discovery. Soon afterwards it was used in England and Germany.

root acts in a similar manner when it is overdosed. When such symptoms occur, either from Emeta or from Ipecacuanha, the best remedy is infusion of Galls, or decoction of Uva Ursi or of Ratanhy root, which, forming insoluble precipitates with the Emeta, neutralizes its action and renders it inert.

The powder of Ipecacuanha loses much of its activity by keeping, especially when it has been exposed to the light; and it is rendered inert also by long boiling in water. Owing to a peculiar idiosyncracy, some individuals suffer from severe dyspnœa by inhaling the odour of Ipecacuanha: Emeta is not liable to this objection. Much advantage, indeed, might result from substituting Emeta for the powder of Ipecacuanha, were an easy method of obtaining it discovered: its dose is more easily regulated; and it is more certain in its operation.

The only pharmaceutical preparation of Ipecacuanha, used as an Emetic, is the wine of the British Colleges.

WINE OF IPECACUANHA, *Vinum Ipecacuanhæ*, L. E. D. is made by macerating ℥iiss (℥ii, D.) of Ipecacuanha, moderately powdered, in two pints (f℥xxxii, D.) of Sherry, for fourteen (seven, E. D.) days, and filtering. The wine is seldom employed as an Emetic: f℥iv are sufficient to cause vomiting in an adult.

In this wine, the proportions of the root is one part to fifteen, and sixteen of white wine. It would be preferable to employ Emeta in these preparations, as the other components of the Ipecacuanha root cause fermentation and injure the vinous solution. The wine of Ipecacuanha operates mildly; and is useful in diseases of children, when full vomiting is required.

e. SCILLITINA. This substance is the active principle of the bulb of the Squill; but it is not in this country employed, except as it exists in the Squill.

THE SQUILL. *Scilla*. L. E. D.—The Squill is a native of the shores of the Mediterranean and Portugal, belonging to the natural order Liliaceæ*.

The bulb is ovoid-round, and composed of fleshy concentric scales, covered with a thin brown, in some a whitish coat. It often attains to a very large size, sometimes greater than that of the human head, and weighs from ℥vi to lb. x. It throws up a scape, crowned with a dense, long raceme of pale, yellowish-green flowers, which bear large winged seeds, with three nectariferous glands at the apex of the ovary. The fresh bulb, when much handled, inflames and ulcerates: both in this and its dried state, it is extremely bitter to the taste, nauseous, acrid, and inodorous. The acrimony is greatly diminished by drying. If the fresh juice of the squill or the decoction of the dried bulbs be tested with diacetate of lead, a curdy precipitate indicates the

* Woodville's Med. Bot. third edition, p. 715, pl. 255. Richard, Hist. Nat. Med. t. i, p. 386. Steinheil in Arm. Sc. n. ser. vi, 279. Hayne, xi, 21. Lindley, 591.

presence of gum: tannic acid is demonstrated by gelatin and persulphate of iron; and the phosphate of lime by oxalate of ammonia. If the insoluble part of dried squill be digested in hydrochloric acid, and liquor potassa added to the diluted filtered solution, a precipitate falls down, which is citrate of lime. Ether, when digested on dried squill and evaporated afterwards on water, leaves on the surface a thin pellicle of intensely bitter resinous matter, whilst a soluble matter mingles with the water. Notwithstanding the experiments of Vogel, I am disposed to regard this pellicle as containing the active principle both of the squill and of the Scillitina. According to the analysis of Vogel, squill contains 35 per cent. of *Scillitina*, 24 of *tannic acid*, 6 of *gum*, traces of *citrate* (phosphate?) *of lime* and *saccharine* matter, and 30 of ligneous matter. Tilloy, who also analysed squill, found a fatty matter, besides those components which Vogel described.

The Scillitina is procured by exhausting the fresh bruised bulb with diluted sulphuric acid, and saturating the concentrated solution with lime, and, after leaving this mixture three days at rest, exhausting the precipitate, dried with rectified spirit. The Scillitina thus procured, according to Landerer*, is in prismatic, bitter crystals, insoluble in water, and sparingly soluble in alcohol.

Squill is seldom employed as an Emetic; and is indeed a very uncertain one, sometimes scarcely producing any influence, at other times a very few grains cause violent vomiting. When emetics are thought to be serviceable in ascites and anasarca, Squill has been supposed to be particularly indicated; but it is in no respect superior to tartar-emetic in such cases. Alcohol and vinegar are the menstrua usually employed to take up the *Scillitina*; but the dried bulb may also be given in the form of powder to excite vomiting, in doses of from gr. iv to gr. xvi, or in that of tincture, from m. xxx to f℈i; and of the syrup, which is preferable to the oxymel, from f℈ii to f℥ss, repeating the dose at short intervals until vomiting is procured. From the effects of reagents, it is obvious that the salts of iron and of lead, sulphuric acid, tartar-emetic, and gelatin, cannot with propriety be prescribed in conjunction with Squill.

When Squill is overdosed, it operates as a narcotico-acrid poison, causing vomiting, diarrhœa, griping, and bloody urine; and, occasionally, it also exerts narcotic effects. Vogel details some instances of poisoning which proved fatal, in which doses of the powder of Squill did not exceed gr. xxiv. Sometimes the ordinary dose of the syrup has been followed by vomiting, purging, and pain. In one instance, I saw an eruption resembling nettle-rash follow the administration of Squill: but this might depend on idiosyncracy. In Orfila's experiments, the dogs on whom he tried the poisonous effects of Squill, after

* Thomson's Organic Chemistry, p. 717.

having sustained the influence of the poison for some hours, suddenly became tetanic, and almost instantly died. Orfila thinks that Squill exerts both its beneficial and injurious effects through the medium of the nerves.

f. Nicotina.—Tobacco (p. 308), of which Nicotina is the active principle, has a very powerful emetic influence, whether taken into the stomach or inserted into the rectum, or even applied to the surface of the body; but its operation is too difficult to control, to permit it to be prescribed, under any circumstances, as an Emetic. I mention it here, therefore, not as an Emetic, but to caution against its employment as an agent to excite vomiting.

* * *Inorganic Substances.*

a. Hydrosulphuret of Ammonia.—When a current of sulphuretted hydrogen gas is passed through a solution of pure Ammonia, an union between the gas and the Ammonia takes place, and Hydrosulphuret of Ammonia is formed. It is of a greenish-yellow colour, exhaling a fœtid odour and impressing an acrid, disagreeable taste. It precipitates the solution of all the metallic salts: those of oxides of iron and of lead, black; of copper, a deep brown; of antimony, orange; of mercury, brick red; and of arsenic, yellow. In very moderate doses, this Hydrosulphuret causes nausea, vertigo, and vomiting. It is seldom, however, employed as an Emetic, unless it is requisite to produce at the same time a powerful sedative effect on the system. It is prescribed in one disease which is peculiarly distinguished by the augmented secretion of the kidneys and a change in the properties of the urine, namely, diabetes *mellitus*. The dose is from m. v to m. viii; but the number of minims may be gradually augmented until vomiting be produced.

b. ANTIMONIAL PREPARATIONS.

* *Sulphurets and Oxysulphurets.*

1. Sesquisulphuret of Antimony. *Antimonii Sesquisulphuretum.* L. *Antimonii Sulphuretum.* E. D. *Antimonii Sulphuretum Præparatum.* D.—Sesquisulphuret of Antimony is found native*, and is the most abundant of the ores of Antimony. In order to purify it, the Sulphuret is first separated from the impurities with which it is naturally combined, then covered with charcoal and smelted in a reverberatory furnace, and the refuse removed; it is next run into moulds, in the form of loaves, which are grey externally, and internally foliated or striated and

* The Greeks named it ετιμμι and ετβι.

brilliant, and in this state is called crude Antimony. The largeness of the striæ, the compactness, weight, and volatility of the Sulphuret, mark the goodness of the specimen. It should dissolve completely in hydrochloric acid, aided by heat; but besides the impurities not soluble in this acid, iron may be suspected in it when the colour of the solution is yellow; arsenic, by a garlic odour when the Sulphuret is thrown upon hot coals; and more completely by mixing the Sulphuret with equal parts of bitartrate of potassa, heating to redness for some hours and throwing the alloy into water. If arsenic be present, arseniuretted hydrogen is evolved. The quantity of Antimony in the Sulphuret varies; but the average proportion is about 70 per cent. Sulphuret of Antimony consists of two eq. of Antimony = 125·2, + three of sulphur = 48·3, making the equivalent 173.5*. ($Sb._2 S._3$). It is, therefore, a sesquisulphuret. When Sulphuret of Antimony, in a state of minute division, is thrown into a bottle of chlorine, a powerful action is immediately induced, and a sesquichloride of Antimony results.

Prepared Sulphuret of Antimony (*Antimonii Sulphuretum preparatum* of the Pharmacopœias) is the sulphuret of commerce levigated with water on a porphyry stone. It is inodorous, insipid, of a dark leaden-grey hue, and stains the fingers when it is handled†. It is insoluble in water and in alcohol; but is partially soluble in the vegetable acids, consequently in wine. An emetic wine was formerly prepared by putting wine into cups formed of the sulphuret, on which the acid of the wine acted and acquired emetic properties. When aided by heat, the sulphuret decomposes the sulphuric and the nitric acids. Hydrochloric acid, mixed with the sulphuret and heated, is decomposed, the chlorine is partly given off and partly combined with the antimony, whilst the sulphur combines with the hydrogen, and escapes as sulphuretted hydrogen gas.

The emetic power of Sulphuret of Antimony is uncertain: if the stomach be acescent, it is violent; when there is little or no acid present, it is feeble. The dose, to produce full vomiting, is from a scruple to half a drachm.

2. Oxysulphuret of Antimony. *Antimonii Oxysulphuretum.* L. *Antimonii Sulphuretum aureum.* E. *Sulphur Antimoniatum fuscum.* D.—To form this preparation, the Colleges order ℥vii (℥i, E. one part, D.) of powdered Sesquisulphuret of Antimony to be boiled for two (one, E.) hours in Oiv (f℥xi, E. eighteen parts, D.) of liquor potassæ and cong. ii of distilled

* Berzelius ($H._2 S.$).

† It was with the Sulphuret of Antimony that the Greek and Turkish ladies, to use a Scriptural phrase, "Put their eyes in painting." When applied within the eyelids, it produces a peculiar softness of expression.

water, and the solution strained and precipitated by diluted sulphuric acid: this precipitate, washed with water, dried and rubbed to powder, is the precipitated Sulphuret of Antimony. In this case the potassa dissolves the sulphur, and a Sulphuret of Antimony and of Potassium is formed; on the addition of the acid, water is decomposed, the oxygen of which oxidizes the potassium and forms potassa, which unites with the acid, Sulphuretted Hydrogen is formed by the Sulphur and Hydrogen, and Sulphuret of Antimonii, in combination with Sulphur and Oxide of Antimony, is thrown down. It is an inodorous substance, of a bright orange-red colour, and a slight styptic taste, insoluble in water, and not readily acted upon by diluted acids. Chemists vary in their opinion of the nature of *Kermes mineral**, which this preparation resembles. Berzelius fused Sulphuret of Antimony with black flux, and boiled the residue in water: he thus obtained Kermes, which, he affirms justly, is a hydrated sesquisulphuret; but the precipitated sulphuret contains also some oxide of Antimony, the result of the process: hence it is an oxysulphuret. In washing the precipitate, the water should be merely tepid: boiling water partially decomposes it. This preparation is scarcely ever employed as an Emetic, owing to the uncertainty of its operation. If the stomach be acescent, it operates violently: when this is not the case, it has been given to the extent of ten grains for a dose, three times a day, without any obvious effect.

* * *Protoxides with Acids.*

3. TARTRATE OF ANTIMONY AND POTASSA. *Antimonii Potassio-tartras*, L. *Antimonii Tartarizatum*, E. *Antimonii et Potassæ Tartras*, D.—According to the directions of the London Pharmacopœia, this salt is prepared by mixing lb. ii each of sesquisulphate of Antimony and Nitrate of Potassa, and then adding f℥iv of Hydrochloric acid, spreading the powder on an iron plate and igniting it. The residue is then boiled with f℥xiv of bitartrate of Potassa for half an hour, in a gallon of distilled water: the solution strained and set aside to cystallize. The Edinburgh College orders ℥iv of Sulphuret of Antimony to be dissolved in one pint of muriatic acid, and boiled for half an hour, filtered, and the solution thrown into Ov of water. Three ounces of the precipitate, washed and dried, is next to be boiled with ℥iv and ʒii of Bitartrate of Potassa, and f℥xxiii of water, filtered and set aside to crystallize. The Dublin College orders four parts of nitromuriatic oxide of Antimony to be boiled with fifteen parts

* M. Cluzel says that the finest kermes is formed by boiling, for half an hour, one part of powdered Sulphuret of Antimony and twenty-two parts of crystallized carbonate of soda in two hundred and fifty parts of water: then filtering the solution in a hot vessel, in order that it may cool slowly:—the kermes is deposited as it cools.

of Bitartrate of Potassa, in thirty parts of distilled water, filtered whilst hot, and crystallized*. Care must be taken not to push the evaporation too far, otherwise crystals of uncombined Tartrate of Potassa are formed in the mass of crystals of the Tartrate of Antimony and Potassa†.

The Dublin process has many advantages over the London process. In the first place, the sesquioxide is always the same; for the impurities of the sulphuret from which it is formed, the zinc, iron, or lead, being converted into chlorides, remain in solution in the large quantity of water employed to precipitate the oxychloride of antimony. The theory of the formation of the Tartrate of Antimony and Potassa is very obvious. The oxychloride, when brought into contact with the water and bitartrate of potassa, decomposes a portion of the water, and is itself decomposed: the hydrogen of the water unites with the chlorine, and forms hydrochloric acid, whilst the oxygen combines with the Antimony and forms the sesquioxide, which dissolves in the acid of the bitartrate. The hydrochloric acid which is formed, however, acts upon a part of the bitartrate, and forms chloride of potassium and water, whilst tartaric acid is found in a free state in the solution.

Tartar Emetic, properly prepared, is in regular crystals, the primary form of which is an octohedron with a rhombic base: they are transparent when newly prepared, but soon become opaque. These crystals are white, inodorous, and have a styptic, metallic taste. They are decomposed when exposed to a high temperature in conjunction with charcoal or any carbonaceous matter, and metallic antimony is left. Tartar Emetic dissolves in about fourteen and a half times its weight of water at 60°, and thrice its weight of boiling water. The newly made aqueous solution reddens the tincture of litmus; but, when kept, it gradually spoils. It is slowly decomposed by the pure alkalies; rapidly by the alkaline carbonates, the hydrosulphurets, the acetates of lead, lime water, the salts of lime, cyanide of potassium, and some of the metallic salts; the mineral acids; all metallic salts the bases of which form insoluble compounds with tartaric acid; the decoctions of yellow cinchona bark, and of all vegetable astringents. The precipitate from the latter is a tannate of the sesquioxide of Antimony. It is not, however, decomposed by meeting in the same solution sulphate of soda, or chloride of Barium, or any perfectly neutral salt, or acidulated nitrate of silver, or acidulated acetate of lead: but if the salt be a double salt—as, for example,

* The process of the French Codex requires 125 parts of Glass of Antimony, 185 of bitartrate of Potassa, and 1500 of water: from these, 195 parts of tartar-emetic are procured.

† The sub or protochloride is prepared by boiling 20 parts of sulphuret of antimony in 100 parts of hydrochloric acid and one part of nitric acid, pouring the strained fluid, when cold, into a large quantity of water, and washing the precipitate until every trace of acid be removed.

alum—then a copious precipitate is thrown down. The constituents of this salt are—tartaric acid 36·56, + sesquioxide of antimony 42·65, + potassa 13·29, + water 7·47, = 100·00; or 1 tart. potassæ = 113·63, + 1 ditartrate of sesquioxide of antimony = 219·68, + 3 water = 27, equiv. = 360·31. Berzelius makes the proportions of these components in 100 parts of the salt to be oxide of antimony 27·10, + potassa 12·53, + tartaric acid 53·20, and water 7·17. It is a double salt, in strict language, or contains both a ditartrate of antimony and a tartrate of potassa.

Tartar Emetic is very apt to be adulterated with bitartrate of potassa, and sulphate of potassa. The crystals of Emetic Tartar can be easily distinguished from those of bitartrate of potassa; and, if the Tartar Emetic be dissolved in only 14 parts of distilled water, the bitartrate of potassa will remain undissolved, but when 10 per cent. of the bitartrate is present, the whole dissolves. Mr. Hennell directs a few drops of a solution of carbonate of soda to be added to a boiling solution of the suspected salt: if the precipitate remains undissolved, he regards it free from the bitartrate*. The quantity of Tartar Emetic may be also guessed at by dropping the suspected crystals into a solution of sulphuretted hydrogen gas: if they be the antimonial salt, a copious orange-coloured deposit will be formed on them, which will occur less copiously if the bitartrate of potassa be present. Or a solution of the suspected salt may be tested with a diluted solution of hydro-sulphuret of ammonia, and its goodness judged of from the quantity of orange-coloured precipitate afforded. These tests, however, are far from being delicate, and lead to approximations only to the truth: but $\frac{1}{120}$ of bitartrate in Tartar Emetic may be detected by testing the solution of the suspected salt with acetate of lead suitably acidulated. This test is formed by adding to eight parts of the solution of acetate of lead three parts of *strong* acetic acid. The precipitation by this test is slowly formed: but it is certain, if any of the bitartrate be present. If any sulphate of potassa be present, it will be readily detected by Nitrate of Baryta; if a chloride, by acidulous nitrate of silver. Its purity may be also suspected if the crystals deliquesce. The most frequent adulteration is bitartrate of potassa; in consequence of which, the drug should never be bought in a state of powder.

Tartar Emetic was first discovered by Adrian Mynsicht, and made known as a medicine in 1631, in his Treatise, Thesaurus Medico-Chemicus; but it was invented before that period. It was originally prepared by boiling the bitartrate of potassa with an impure oxysulphuret, the *Crocus* metallorum, as it was termed.

The Tartrate of Antimony and of Potassa excites locally the surfaces with which it comes in contact, as is rendered evi-

* Phillips' Trans of the Pharm. 4th col.

dent by applying it to the skin (see under *Suppuratives*, Section xviii,) and by the acute pain, vomiting and purging, which it induces when taken in very large doses into the stomach. But Tartrate of Antimony and Potassa operates as an Emetic through the medium of the nerves; and perhaps never until it reaches the circulation. It proves Emetic, or purgative, or diuretic, or sudorific, or an indirect sedative, according to the extent of the dose, the frequency of its repetition, and the temperature of the surface of the patient. Thus, when a grain, dissolved in a moderate quantity of water, is given every ten or fifteen minutes, it produces full vomiting: the same quantity repeated every three hours, vomits once or a second time, but afterwards operates as a sedative; and given every five or six hours, it operates as a powerful sudorific, or it purges; or causes diuresis if the surface be kept cool. It is, perhaps, the best of the emetic substances for producing vomiting in the commencement of continued fevers. It is also given with advantage as an Emetic wherever continued nausea is likely to prove useful. Were this the place to extend our remarks on this preparation, beyond its influence as an Emetic, it would be easy to prove that it might supersede all the other antimonial preparations.

When overdosed, it excites violent vomiting, hiccough, a burning sensation at the stomach, hypercatharsis, with other symptoms of inflammation of the mucous membrane of the alimentary organ, and death*. When this occurs, the stomach should be directly evacuated by the stomach pump, and, in addition to the means employed, the patient should be urged to drink freely of a decoction of yellow cinchona bark, or of galls, or catechu. It is difficult, however, to say what is an overdose of Tartar Emetic, as the most extraordinary doses have been prescribed by Rasori in Italy, and by other Continental physicians. It was a common practice to prescribe it in large doses, in the seventeenth century; but this custom fell into disuse and was only lately revived. Twenty grains, and in one case forty-eight grains, were given, in divided doses, in twenty-four hours, by Laennec, without producing any deleterious effect, and without producing vomiting after the first day. I have frequently prescribed it in doses of from gr. ii to gr. iii every three hours, and have seldom found that vomiting was caused after the third dose. Dr. Christie, in a Treatise on the Nature and Treatment of Cholera, asserts that he has given ℈i at once, with the effect of exciting some vomiting and several watery stools. M. Rasori explains the power of sustaining such large doses, on the principle that a peculiar diathesis accompanies diseases of excitement,

* Orfila relates a case, in which ℈ii caused vomiting, hypercatharsis, and convulsions, and was followed by death in four days after taking the poison.—*Traité de Poisons*, t. i, par. 1, p. 216.

in which only such doses can be borne; and he affirms that it ceases as the recovery takes place. Laennec, however, says that this power of endurance does not cease at the close of the fever, although it is diminished. It is probable that the absence of vomiting after the first or second dose depends on the topical excitement which it induces preventing the absorption, whilst at first some portion is absorbed and causes vomiting. This influence on the mucous membrane is also demonstrated by the condition of that membrane. When death has followed an overdose, it displays traces of inflammatory action, and ulceration has been observed in the œsophagus and the small intestines.

When Tartar Emetic proves poisonous, the symptoms closely resemble those of cholera; violent vomiting, diarrhœa, great pain and tension in the region of the stomach, and delirium: the body swells, convulsions supervene, and death sometimes results. I have seen these symptoms follow the administration of moderate doses in some habits. On the examination of the body after death, the only appearances to explain the fatal result, are slight congestion in the brain, with a red, thickened state of the villous coat of the stomach, which has also been found covered with a tough mucus. Similar appearances in the duodenum are all the marks of previous excitement that have been observed.

From what has been said of the action of the cinchona bark, there can be no hesitation in believing that that infusion, and other astringent vegetable infusions and decoctions, are the best antidotes in poisoning by Tartar Emetic. Cases related by Serres, in the work of M. Orfila, and by Dr. Sauverton of Lyons, were saved by these means. In cases, even of severe vomiting, from ordinary doses of Tartar Emetic, I have checked this inconvenience at once, by administering two tea-spoonfuls of tincture of cinchona bark in a small portion of water, every ten minutes until the vomiting ceased.

To prove that poisoning has taken place from the administration of Tartar Emetic, the following simple plan, suggested by my learned colleague, Dr. Turner, is perhaps the best that can be adopted. Collect the vomited matter, or the fluid that has been taken, dilute it with distilled water, and acidulate with a little hydrochloric and tartaric acids, in order to coagulate any animal matter that may be present, and to bring, as it were, the whole of the antimony into the fluid. The fluid is next to be filtered and treated with sulphuretted hydrogen gas, and the precipitate collected and dried. This is now placed in a tube, and a stream of hydrogen gas passed slowly over it, which, carrying off the sulphur, leaves the antimony in its metallic state. To determine that the metal is antimony, Dr. Chris-

tison proposes to dissolve it in nitric acid, and again precipitate it by sulphuretted hydrogen to obtain the orange precipitate.

Tartar Emetic, to cause vomiting, is administered either in the entire state, or in solution in water, or in solution in wine. In the entire state, it operates most directly as an Emetic in doses of gr. ss to gr. i, repeated at short intervals.

WINE OF POTASSIO-TARTRATE OF ANTIMONY. *Vinum Antimonii Potassio-tartratis.* L. *Vinum Antimoniale,* E. *Liquor Tartari emetici,* D.

The Antimonial Wine of the London and the Edinburgh Pharmacopœias is made by dissolving forty grains of potassio-tartrate of antimony in one pint of sherry. In the Dublin preparation, no wine is ordered. It is directed to be made by dissolving ℈i of the salt in f℥viii of distilled water, and adding to the solution f℥ii of rectified spirit. There is an objection to the use of some wines—the tartaric acid which it contained is said to be attracted by the potassa of the triple salt, and this being converted into a bitartrate, the affinity which retains the potassa as a compound of the antimonial salt is thus broken, and decomposition results. The composition of the preparation made with good sherry does not, however, undergo such changes; but some alteration is likely to take place by time, even in a preparation like the Dublin, which, notwithstanding one fourth part of rectified spirit is added to the quantity of water employed, must still be regarded as an aqueous solution. If an emetic wine be necessary in the cases of children, and the Tartrate of Antimony and Potassa be preferred to ipecacuanha as the active ingredient, it is better to make the solution at the time when it is wanted, than to keep it ready prepared in either wine or weak alcohol*.

THERAPEUTICAL EMPLOYMENT OF EMETICS.

As therapeutical agents, Emetics are of great importance, and indicated in a much more extensive range of diseases than might be supposed by those unacquainted with the practice of medicine. The ancients were much addicted to the use, or rather the abuse, of vomiting†. They employed Emetics as an adjunct to personal gratification; to enable them to relish the enjoyments of the table; and so far was this custom carried,

* Originally the wine of antimony was prepared by putting wine into cups made of sulphuret of antimony: the acid of the wine acted upon the oxide of the sulphuret, and dissolved enough of it to acquire an emetic property. It was afterwards prepared by dissolving glass of antimony, the fused protoxide of the metal, in wine. In both cases the character of the preparation varied with the strength and acidity of the wine.

† "Ægyptii olim omnes morbos curabant vomitu et jejunio." *Bohemius,* lib i, cap. 5.

that they sometimes evacuated from the stomach what they had eaten in one course, that they might be the more capable of enjoying that which was to follow. According to Seneca, "they vomited that they might eat, and ate that they might vomit*." They employed Emetics before meals, that they might be enabled to eat more plentifully; and often they concluded a feast with an Emetic, to prevent the bad consequences of their gluttony†. They also regarded vomiting as a means of preserving the tone and vigour of the body; and therefore it formed part of the discipline of the Athletæ. Asclepiades, however, condemns the practice, and his objections to the abuse of Emetics led him to reject them altogether‡. Without going the same length, we may affirm that experience has fully proved the folly of the ancient practice, and the injurious effects of a frequent repetition of Emetics; which invariably produce debility and such an irritability of stomach, that vomiting is excited by the smallest change in the food: indeed, no means are so likely to induce dyspepsia as this custom.

The first description of diseases that naturally present itself as likely to be benefited by Emetics, is that affecting the stomach itself, *Indigestion*. There are only two varieties of indigestion in which Emetics are indicated: *Atonic* gastric Dyspepsia —and *Follicular* gastric Dyspepsia. In the first, a sensation of weight at the stomach, heartburn, acid, bitter, or putrescent eructations, with a slimy, loaded tongue, an excessive secretion of saliva, paleness of the countenance, headache and disordered and impaired vision, indicate that the organ is loaded and oppressed with crudities or offensive matters, and point out the necessity of the administration of Emetics. In the commencement of the disease, an Emetic may at once arrest its progress; and, in many instances, the greatest relief is obtained from the occasional repetition of it: but if the disease have assumed a chronic form, it sometimes becomes injurious instead of salutary to employ Emetics. In the condition of the stomach which, in this disease, requires the aid of Emetics, mustard, or infusion of chamomile flowers, are preferable to other substances for exciting vomiting, which is indeed so easily produced, that sometimes a little salt and tepid water, or even the titillation of the fauces, is sufficient for the purpose. After the operation of

* "Vomant, ut edant; adunt ut vomant."—*Cons.* ad *Helv.* 9, § 10.

† In one of Cicero's Epistles to Atticus, he describes a visit which he had made to Cæsar at a villa near Rome; and he states that Cæsar paid him the high compliment of taking an Emetic before dinner, when he understood that Cicero intended to spend the day with him. "Accubuit ἐμετικὴν agebat, itaque et edit et bibit ἀδεῶς et jucunde." *Ad Att.* xiii. 52.

‡ De Sanitate Tuendo.

the Emetic, the tone of the stomach is most readily restored by sipping small quantities of *cold* water, at short intervals.

In the second variety of Indigestion to which I have referred, the disordered condition of the mucous follicles is occasionally corrected by the operation of an Emetic. Ipecacuanha is well adapted for this form of the disease; it is supposed to benefit by stimulating and emulging the follicles: but it ought not to be given unless clearly indicated, nor ought it to be too frequently repeated. The symptoms which more particularly demand the aid of an Emetic, are nausea and the vomiting of a clear, glairy, ropy, tasteless fluid; which is, indeed, the immediate cause of much of the painful feelings in this form of indigestion; and, from its accumulation in the night, independent of a variety of uneasy sensations which it induces, it becomes a cause of daily vomiting. It is a curious fact, that the offending matter is ejected whilst the food is retained.

The administration of an Emetic, in the early stage of fever, often cuts short the disease; and, consequently, in all cases in which blood-letting is not indicated, Emetics may be prescribed, unless the attack have been ushered in by vomiting, or epigastric tenderness, or a determination to some organ, especially the head; or by a marked prostration of strength. The benefit derived from the employment of Emetics seems to depend on the shock which they give to the system, rousing its vital powers into new action, and, by diffusing the blood over the body, restoring the balance of the circulation, the loss of which causes that state of collapse in the superficial capillaries which forms the most striking of the early symptoms of fever. An equable balance of the circulation is, indeed, essential to health, in maintaining the moderate but due temperature of the body, and promoting the proper action of the secerning system. Hence the great importance of an Emetic in removing not only offending matters from the stomach, but in removing thirst and heat. In selecting the emetic substance, we ought to keep in view those circumstances which constitute the natural crisis of fever; and as the most striking of these is diaphoresis, the tartrate of antimony and potassa is the best emetic substance that can be employed, as it both produces full vomiting and powerfully determines to the surface. When the strength is rather low, if vomiting be nevertheless indicated, Ipecacuanha is preferable; but it has one disadvantage, namely, it frequently, instead of vomiting, passes off by the bowels, an effect which it is often important to avoid in fever.

The best period of the day for administering Emetics in continued fevers is the evening; and the reason for this is obvious. In almost every case there is a mid-day and an evening exacerbation of fever, and a consequent remission; yet one only

is clearly observed, that which occurs in the evening, and the remission, which is towards morning. Now this evening exacerbation is marked by increase of pulse, thirst, headache, and an augmentation of the heat and dryness of the skin; its approach is, therefore, very obvious; and it is immediately before this accession that an Emetic is given with the greatest prospect of benefit. Even if the disease be not advanced, and the Emetic do not cut it short, the paroxysm is always diminished in violence by its action.

In Intermittents, the influence of Emetics is still more decisive than in continued fevers. They are administered with most advantage at the commencement of the cold stage, or a short time prior to its recurrence. This practice, which Celsus informs us was that of his time, is still followed by most practitioners of the present day. It always mitigates the violence, generally completely cuts short the paroxysm, and breaks the diseased catenation of symptoms which constitute the disease. The only circumstance that can contraindicate the use of Emetics in such cases, is great plethora, with a determination to the head, or tenderness of the epigastrium. The mode in which the Emetic produces its advantageous results is the same as that which I have explained as cutting short continued fever: the shock rouses the vital powers, overcomes the superficial collapse, and, by the equalization of the circulating fluids, brings on diaphoresis, the natural crisis of each paroxysm: whilst this interruption to the routine action of the disease breaks the diseased habit set up in the system, and enables the more regular movements of health to supervene. If the administration of one emetic action, however, do not succeed in arresting the progress of the fever, it is not likely that a repetition of it will prove useful; on the contrary, the debility which results is calculated to change the type to a worse than that which already exists: thus a tertian is changed into a quotidian, and this into a continued fever. In every case of Ague, the exhibition of the Emetic should be regarded only as preparatory to the use of antiperiodics. The best Emetic is Ipecacuanha, which may be given in a dose of ʒss to an adult; but if we are anxious to maintain a diaphoretic effect after the action of vomiting, and have no reason to fear debility, then tartar emetic is preferable, as it both produces a greater shock, and determines more decidedly to the surface: six grains may be dissolved in f℥vi of water, and a table spoonful given, every ten minutes, until vomiting be produced; and if this do not soon occur, activity may be given to the dose by diluting with acidulated fluids.

In one form of Intermittent, attended with violent pain on one side of the head, or what is denominated *Cephalalgia periodica*, nothing so rapidly cures the disease as an emetic administered the instant the pain begins to be felt; and this

followed, in the intervals, by small doses of disulphate of quina. This complaint, although having all the characters of a quotidian ague, is often obviously connected with rheumatism, or some diseased state of a nerve, as in toothache or neuralgia. It is very readily distinguished from all other headaches by the circumscribed site of the pain; sometimes confined to a single point, such as the inner angle of the eye, or where the supra-orbitar nerve passes out of the orbit; and also by its regular periodical return.

Experience has fully proved the advantage of Emetics, after bloodletting, in many inflammatory diseases; but in none more than in *Croup*. In the early stage of this disease, when the breathing becomes affected, and the symptoms of inflammatory fever are decisive, an Emetic should be given without delay; and occasionally repeated: but it is in the second stage that this class of remedies is most beneficial. Dr. Cheyne, of Dublin, has particularly improved the treatment of this frightful affection, by the introduction of the use of Tartar Emetic, in small doses, in this stage of its progress. He recommends half a grain of this salt, in a table-spoonful of water, to be given to a child of two or three years of age, every half hour, until sickness and vomiting are produced; and, in two hours after the last act of vomiting, the same process to be recommenced, whilst the strength will admit of it. Dr. Cheyne recommends this practice on the supposition that every part of the trachea, from the larynx through the ramifications of the bronchial tubes, is in a state of active vascular excitement; and whilst the action of the emetics tend to moderate this state, they, at the same time, dislodge the exhaled matter which fills the bronchial tubes. He affirms that, in cases where children have survived this second stage of the disease, they have all recovered whilst using the Tartar Emetic. My own experience strictly accords with that of Dr. Cheyne. In ordinary affections of the trachea, Emetics are less indicated; although I have seen them frequently prove extremely serviceable.

In common inflammation of the tonsils, Emetics, given early, often cut short the disease; and if they do not, then always moderate its violence. I have frequently observed that they afford more relief to the inflammation of the fauces than any local remedy that can be employed, not even excepting local bloodletting. Some of the best of our old practical writers bear ample testimony to their salutary influence: indeed, Lieutaud says he has seen patients, labouring under acute inflammatory sore throat, snatched from the jaws of Death by an Emetic; and I can conscientiously bear my testimony to the truth of this remark. In a more advanced stage of the disease, when abscess has formed in a situation not readily reached by the knife of the surgeon,—as soon as it is ripe, nothing is so likely to evacuate it

as an Emetic. In such cases, as the simple act of vomiting only is required, Sulphate of Zinc is preferable to any of the vegetable Emetics, or to Tartar Emetic. When the abscess bursts spontaneously in the night, and the pus is poured into the stomach, the administration of an Emetic on the following morning is always attended with beneficial effects.

In malignant sore throats, *Cynanche maligna,* in which the fever is typhoid, and the tonsils are ulcerated, benefit is derived from the early employment of Emetics: but this advantage is confined to the early stage; for the debility attending the advanced stage contraindicates their employment.

Ophthalmia frequently resists bloodletting, both general and local, and all other depleting measures: in such a case, an Emetic of the Tartrate of Antimony and Potassa, with the view of exciting full vomiting, and maintaining nausea and diaphoresis after its action, is often productive of the greatest benefit. The dose should be administered in the morning, whilst the patient is still in bed; and it should be followed by a moderate purgative in the after part of the day.

In *Amaurosis,* arising from simple diminished excitability of the optic nerve, and a consequent nearly total blindness, without any evident local disease of the eye or of the brain, Emetics prove useful. This condition is distinguished by the dilatation and contraction of the pupil, whereas in real amaurosis the pupil is immoveable. I have had several cases of this description, and have been fortunate enough to cure them by Emetics; following their action with blistering on the temples, and sprinkling Strychnia over the blistered surface. The practice of treating such cases with Emetics originated with Richter.

In *Pneumonic inflammation,* Emetics are assuredly remedies of minor importance: but from the success which has attended their use in the hands of Stoll and many other eminent physicians, we cannot doubt of their utility: indeed, I have met with few cases in which advantage has not resulted from Emetics, in the early stage of the attack: and the stethoscope has generally demonstrated the resolution of the inflammatory action: but it must be recollected that severe and continued vomiting is not only not indicated, but is even hurtful. In the early stage of the disease, Emetics may tend to break the chain of morbid action, before the congestion is converted into inflammatory action. Even after this period, when all excitement has been reduced by bloodletting and other means, when the cough is kept up by irritation in the bronchial tubes, and the expectorated matter is viscid, and dyspnœa is present, the consequence of loaded lungs, Emetics prove useful. In infants thus affected, they are particularly beneficial, as the stomach is often disordered by the sputa being swallowed; and, in relieving the stomach, the pressure exerted upon the air passages in the act of vomiting

tends to unload the pulmonary tubes of the viscid mucus with which *they* are obstructed. In some convulsive coughs—such, for example, as Hooping-cough—experience has undoubtedly verified the popular opinion of the use of Emetics. In this particular disease, which probably depends on a morbid state of the spinal cord, or of the ganglionic plexus, they seem to operate almost as counter-irritants.

In cases of *general convulsions*, especially when these depend on substances taken into the stomach which affect individuals of a peculiar idiosyncracy, and in cases of poisoning, the first object is to evacuate the stomach; and where this cannot be done by the stomach pump, or when this useful instrument is not in the way, Emetics are our only resource. As, in this case, our only object is simply to remove offending matters from the stomach, the *direct* Emetics, those which operate the instant they are taken into the stomach, and operate only once, without subsequent nausea, namely, the *Sulphate of Zinc* and *Sulphate of Copper*, are indicated. A scruple of the former, and from ten to fifteen grains of the latter, may be given.

In *Infantile convulsions*, although Emetics are not always indicated, yet I have, occasionally, observed that they have produced the most decided advantage: and, as this form of convulsions often depend on crude undigested matters remaining in the stomach, or from improper things having been given to the child, it is almost always proper to prescribe an Emetic, if the causes of the attack be not very obvious, and if no congestion nor inflammation be present in the encephalon.

In *Asthma*, when the paroxysm supervenes to a full meal, or where, from a sluggish action of the digestive organs, the stomach is loaded, benefit is always more or less experienced from Ipecacuanha Emetics. This practice was strongly recommended and followed by Floyer, Akénside, and Bree. Akénside gave ℈i in the paroxysm to induce full vomiting, and gr. v, in the intervals, every morning, or gr. x, every other morning, to produce moderate vomiting; but he thought it was equally beneficial if only nausea followed its use. Squill, when it causes vomiting, is strongly recommended by two writers who were capable of judging, from their personal feelings, of the value of any remedy in this disease:—I refer to Sir J. Floyer and Dr. Bree, both of whom suffered from Asthma, and both have written treatises on the disease. Notwithstanding the high authority of these writers, in favour of Emetics in Asthma, they are not generally beneficial: much depends on the condition of the stomach, whether they are indicated or contraindicated. When the tongue is red, and adhesive, they should never be given.

In *tubercular Consumption*, Emetics were employed by Hippocrates, Galen, and Diocles, among the ancients: by Bennett, Morton, Etmuller, Wainwright, Russell, Bryan Robinson,

Marryat, Donald Monro, Macbride, and others, among the moderns, with various success. Dr. Reid says that he never found their frequent repetition prove hurtful in Phthisis, although he often prescribed them for weeks together; on the contrary, he scarcely met with one instance in which the general health was not very greatly improved. Dr. Young, who himself fell a sacrifice to this merciless disease, remarks that "a very great majority of the cures of consumption, which are related by different authors, have been performed either by Emetics, or by decidedly nauseating remedies. The confidence of Dr. Reid and Dr. Simmons in the use of Emetics in Phthisis was unbounded. They sometimes employed Ipecacuanha, sometimes Tartar Emetic: and they assert that they have not only relieved, but cured the disease by these means. It is remarkable that, after such unexceptionable authorities in favour of the value of Emetics in Phthisis, their employment should have been discontinued. It was reflecting upon this fact, and from observing the hopeless treatment of the disease by other means, which induced me to try them; and I have no hesitation in confessing that they form the only articles of the Materia Medica which have ever proved useful in my hands. Nevertheless, I wish I could say that I have ever seen more than one case of advanced Phthisis cured by their means.

The report of the beneficial influence of Emetics by Dr. Giovanni de Vittis, chief military physician to the Neapolitan army, is the most remarkable, as it is the most recent. He states that, between the 1st of May, 1828, and 18th of January, 1832, there were sent out of his Hospital, perfectly cured,

47 cases of incipient Phthisis;
102 —— in the second stage of the disease;
27 —— in the third stage;

176 cases, all treated with Emetics of Potassio-tartrate of Antimony, given night and morning. When purging occurred, it was checked by burnt Ipecacuanha, and Digitalis, each one grain, administered every hour.

Full vomiting mitigates many of the symptoms of Phthisis: it allays the cough, checks diarrhœa—a most important circumstance; and diminishes hectic. The theory of their beneficial influence is not complicated. They operate partly in a mechanical manner, by agitating the superior lobes of the lungs, so as to prevent the deposition of tuberculous matter which usually takes place there; or, if it be already deposited, by augmenting the bronchial secretion and aiding its ejectment. They prevent, however, not only the accumulation of the tuberculous matter, but they promote the general equalization of the circulation, improve the biliary secretion, and tend to diminish abdominal congestion; all of which effects are salutary in Phthisis. When

gastric irritation, however, exists, Emetics augment this and become hurtful: consequently, when the tongue and the fauces are red, congested and swollen, the pharynx dry and shining, with tenderness on pressure of the epigastrium, they should never be administered. A question here presents itself—how far are the obvious advantages derived from a sea voyage to be attributed to the vomiting, and almost constant nausea, that it causes in one unaccustomed to the sea?—The efficacy of the voyage is undoubted: and much is due to the nausea and vomiting, from the same causes that produce their beneficial effects on land.

In the latter stages of the disease, the debilitating influence of Emetics prove an insuperable bar to their employment. With regard to the choice of Emetics in Phthisis, Dr. Young remarks that much has been said in favour of sulphates of zinc and of copper; but he sees no reason in preferring them, in any case, to Ipecacuanha. He, indeed, thought so highly of this vegetable Emetic, that, in speaking of its power of subduing hæmorrhages of all kinds, he says, "I am disposed to consider it as a medicine little, if at all, inferior in importance to cinchona or mercury." I regret that my experience does not permit me to go along with Dr. Young in this eulogy. He gave it in doses of fʒss to f℥ii of the wine, every four hours, in an emulsion, or in the infusion of Cusparia. His object, however, was only to nauseate, *not to excite vomiting*. Notwithstanding this opinion of Dr. Young, there is much reason for preferring the Sulphates of Zinc and of Copper to Ipecacuanha, in the treatment of the latter stages of Phthisis; the former do not debilitate by their action, the latter proves powerfully weakening by the diaphoresis which follows its emetic operation. Morton's Emetic in Phthisis was Squill; Maryat's was gr. i of Tartar Emetic and gr. iii of Ipecacuanha; Read preferred simple Ipecacuanha; Simmons, Sulphate of Copper. The choice of the Emetic should be regulated by the period of the disease and the condition of the patient: the nauseating Emetics are best suited for the *early* stage of the disease; direct, non-nauseating Emetics, for its *advanced* period.

In *Hemoptysis*, which often is the result of tubercular disease, Emetics are employed as derivatives; they are supposed to possess a threefold advantage, of causing a *revulsion*, of producing a *sedative* influence on the heart, and of *determining* to the skin. Accidental vomitings are always followed by benefit, in hemoptysis; and, from having observed this, I have long been in the habit of prescribing them, and have never failed to perceive some advantage to follow their administration.

In *Dysentery*, Emetics are favourites with many parctitioners, under the idea that they favour the equalization of the circulation: one circumstance, however, which is too little attended to, renders Emetics improper in Dysentery: I refer to those instances

in which the liver is primarily and principally affected with either inflammation or augmented sensibility. In general, more advantage is obtained from nauseating and diaphoretic doses of Ipecacuanha, than from Emetics.

In some of the eruptive fevers, Emetics are very valuable auxiliaries to other remedies. In the commencement of Scarlatina anginosa, they are strenuously recommended by some good writers on the disease. Dr. Withering, for example, prescribed them always in its commencement, and sometimes during its progress; I am of opinion, however, that their employment should be restricted to the first period. The shock which they give to the system by the action of vomiting is followed by decided improvement in the general symptoms, and in the feelings of the patient. So partial are some practitioners to their use, that Dr. Rush is said to have administered an Emetic, combined with Calomel, in every case that he treated; and when nausea remained, he repeated the Emetic with evident advantage. In my own practice I have employed Emetics freely, and always with decided benefit.

In the writings of some of the older physicians, we shall find that Emetics were employed in *Dropsy;* but they have not answered the praises bestowed on them, and therefore they have been almost banished from modern practice.

Jaundice may arise from any cause that can impede the flow of the bile into the duodenum, and, also, the non-elimination of that fluid from the blood in its passage through the portal circulation. The first set of causes may depend on diseased states of the liver, the gall bladder, or the ducts; or diseased states of the duodenum, or other contiguous viscera; or foreign bodies, biliary calculi, concreted bile, or hydatids obstructing the biliary ducts. The causes of the non-elimination are not so obvious. The former are the most common. The calculi obstructing the passage are formed in the gall bladder, and are impacted in the common duct. Among other means adopted for facilitating their passage we find Emetics. They are powerful agents, but not always safe; for, as Emetics operate by compressing the gall bladder and impelling forward the calculi, and these bodies being angular, rupture of the duct may take place: the mechanical force, also, behind the calculus, is more likely to increase the spasm which always attends the passage of a calculus, than to relax it. It is, however, true, that the nausea induced produces relaxation of the ducts; and, therefore, if Emetics be employed, they should be such as to induce nausea after their operation; but, on the whole, my experience does not authorize me to recommend this class of remedies in obstructions of the biliary ducts. In Jaundice arising from other causes they are of no value.

In few diseases have Emetics been more generally employed

than in *Insanity*. Foville, Esquirol, Rush, Dr. Cox, Dr. Wake of the York Lunatic Asylum, Dr. Hallaran, Mr. Hill, and Dr. Pritchard, speak more or less favourably of their employment; whilst Dr. Haslam affirms, that "after the administration of many thousand Emetics to persons who were insane, but otherwise in good health, he never saw *any* benefit derived from their use;" and Dr. Burrows is equally sceptical as to their utility. Let us examine, a little in detail, the weight of these contending opinions.

Esquirol says that he has found them useful in most cases of melancholy, accompanied by a torpid state of the system. Both this distinguished pathologist and M. Foville consider that they prove beneficial, from being fitted to excite new actions and to stimulate the secreting function of the abdominal viscera; and these powers are exactly those required in cases of hypochondriacal melancholy, in which both the animal and the physical functions require the aid to such excitants. Dr. Cox remarks, that "in every species and degree of maniacal complaints, from the slightest aberration of intellect that accompanies hypochondriasis to the extreme of mania *furibunda*, emetics have proved most valuable and efficaceous remedies." Dr. Hallaran judiciously points out both the advantages and disadvantages of Emetics. He says, were it possible to meet always the incipient form of Insanity, as in fever, then the timely interposition of an Emetic might at once interrupt its progress, or, at least, moderate greatly its violence. But the indiscriminate employment of Emetics in all the stages of Insanity leads to much mischief; especially when congestion exists in the brain. There is sometimes a great tolerance of Emetics in Insanity; and this, along with the mass of mucus with which the stomach is lined, accounts for the great torpor that prevails, and which prevents Emetics from producing their desired effects; and is the reason of the large doses that are always required to stimulate the action of the stomach when Emetics are employed in Insanity. Dr. Hallaran recommends a combination of Emetics and purgatives; for example, of gr. iii or gr. iv of Tartar Emetic with ℥iv of Sulphate of Magnesia, in a pint of water, of which f℥ii may be given every hour, until some vomiting or purging be produced; and he finds that generally the entire solution is expended before any discharge is brought about. At length, the fæces, which are at first dark, slimy, and intolerably fœtid, assume a natural, bilious appearance, and are less offensive; the breath ceases to be tainted; and the system at large enjoys at least a temporary repose. He is of opinion that, on the whole, Tartar Emetic, in doses sufficient to excite vomiting, when administered in recent cases of Insanity, is capable of completely reducing the maniacal hallucinations in the most satisfactory manner. Mr. Hill says "Emetics have always appeared to me to rank deservedly high

in the cure of Insanity, proving salutary in proportion to the degree of existing torpor in the stomach and intestines." He quotes Willis, who thus expresses himself: "the deeper seminaries of disease are seldom cleared out without the administration of vomits; but especially in the disorders of the brain and nerves, where their use is found to be most advantageous." Mr. Hill advises that no liquid food be allowed for a few hours subsequent to the operation of the Emetic; and he adds, that for the very reason that the action of vomiting is retrograde to the natural action of the stomach, Emetics become, in Insanity, the best adapted of remedies. By setting up a new action, they prove directly curative: and Dr. Wake remarks, that, after an extensive experience in the use of different remedies on the patients of the York Lunatic Asylum, he found no class so frequently efficacious as Emetics.

On the contrary side of the question, Dr. Burrows accords, to a certain degree, with the opinions of the older writers; but in his mind the benefit which Emetics effect does not depend on their evacuant property, but rather from the well-known effect that vomiting produces on the circulation. Nevertheless, he adds, that "after several years perseverance, my confidence in Emetics alone, in cases of Insanity, has been entirely dissipated. Still," he adds, "I have occasionally recourse to Emetics, but only as I would in other diseases, to free the stomach from troublesome ingesta, accumulated phlegm, or morbid bile; and sometimes to give activity to torpid viscera, and to rouse and emulge the general system." Dr. Burrows also thinks that "Emetics are occasionally useful, by interrupting intense abstractions, and morbid hallucinations, and capricious resolutions. Where the urine has been retained from obstinacy, the operation of an Emetic will generally evacuate the bladder. In like manner, it will sometimes act on the rectum when the fæces are withheld. Dr. Haslam says that, in many instances, and in some where bloodletting had been previously employed, paralytic affections have within a few hours supervened the exhibition of an Emetic, more especially where the patient has been of a full habit, and has had the appearance of an increased determination to the head.

Now I cannot pretend to decide between such contending opinions from my own limited experience in Insanity; I am not, however, very sanguine in my expectation of benefit from Emetics in mania. In that species of Hypochondriasis that borders on Melancholia, and in Melancholia itself, I have found them very beneficial. The bowels, in such cases, are generally torpid, and the stomach deficient in the ordinary powers of digestion, and, consequently, they are apt to be loaded with viscid mucus. In such a condition of the stomach, an Emetic not only clears away the offending matter, but it invigorates the digestive powers,

and the influence of the remedy, extending beyond the stomach and aiding the assimilating process, conduces greatly to the re-establishment of both mental and corporeal health. It may also be added, that Emetics are sometimes the means of producing calmness and a mitigation of violence during a paroxysm of furious excitement; and their operation is followed by a restoration of sleep and tranquillity. In looking, indeed, at the action of Tartar Emetic, I am much disposed to regard it as a counterirritant, and to think that the benefit is less the result of the vomiting than of its topical action on the mucous membrane as a derivant.

The best Emetic in cases of Insanity is Tartar Emetic. It does not excite vomiting, however, in this disease, in doses under six grains; and, especially, when it is administered during a paroxysm of violent excitement. It is, however, better to begin with moderate doses, and to combine Ipecacuanha with the Tartar Emetic.

In some local affections, such as indolent tumors, especially buboes, emetics prove useful, either by dissipating them by revolution, or by promoting suppuration. Upon the whole, this group of medicines, like every other, may prove useful or deleterious, according to the degree of caution, discrimination, and judgment with which the substances contained in it are administered.

SECTION XI.

VITAL AGENTS WHICH OPERATE ON THE SECERNING AND EXHALANT SYSTEMS.

In examining those classes of medicinal agents which operate on the *secerning* and *exhalant* system, I may preface my remarks by a brief sketch of the nature and functions of those parts of the animal œconomy.

1. Secretion is the abstraction of some of the components of the blood, during its passage through the capillaries, and its conversion into new substances. Under this term, however, two distinct transformative processes are carried on; one *nutritive*, the other *excretive*. With the former, this class of medicinal agents is not immediately connected; although, through their influence upon the latter, they aid it; and restore its salutary action when that is morbidly deranged: the latter is directly modified by their influence upon either the organs themselves, or their excreting pores or ducts. As the *excretive secretions* differ greatly from one another in the simplicity or complexity

of their preparation, the organs must necessarily differ also; but, in whatever manner they are produced, the capillaries are the intermediate organs between the arteries and the veins, from the blood of which, with the exception of the bile, all the excretive secretions are formed. The most simple secreting organs are *vital pores*; the next are *follicles* and *cryptæ*; the most complicated are *glands*. Little is known respecting either the *vital pores*, or their mode of performing their functions: the *follicles* or *cryptæ* are better known; but it is difficult to fix the precise line of demarcation between them and *glands*; it is only known that some are simple and solitary, others are grouped or agglomerated; whilst some again are compounded.

The simplest follicles present, in their interior, cellular dilatations, or their sides are formed of cœcal tubes, lying perpendicular to their surface. Many follicles are aggregated, as exemplified in the Meibomian glands; and often those clustered follicles open by a single orifice. Some follicles, again, consist of a convolution of simple canals, that display, nearly throughout, an equal diameter.

Glands or *follicles* are, therefore, irregularly constructed bodies, and present many varieties. But the most simple gland, a mere recess on the surface of a membrane, as well as the most complex gland, with its ducts, canals, or tubuli, may be regarded as extended organized surface, on which the change of the blood takes place. It has been supposed that the glandular capillaries are furnished with invisible exhalant pores, which permit the escape of the secretion in one direction only, namely, into the cavity of the glandular canals. But surely we cannot regard secretion as a simple exudation? However it may be performed, it cannot be explained by mechanical principles, which could never account for many facts exhibited by it. To take one example only, how can "the suddenness and abundance of the secretion of tears, excited by a momentary mental impression, be thus explained?" It has been referred to electrical action; but many objections may be raised to this opinion. All glands open their excretory ducts either on the mucous membranes or on the skin. It is upon these ducts, or rather upon their extremities, that the group of medicinal agents, the examination of which we are now about to engage in, operate.

The manner in which the blood is altered, or converted into secreted fluids, has not yet been explained: some have supposed the change to be purely mechanical; others that it is as exclusively chemical: all that we can affirm with certainty is, that it is the result of a function of the organized and living substance. It certainly does not consist of mere exudation, but depends on a vital action of the secreting membranes: and there is no doubt that it is much modified by nervous action. As far, at least, as glands are concerned, secretion is subject to the nerves,

and is much influenced by emotions of the mind; a fact demonstrated by the quantity of saliva poured out, and the equally abundant flow of tears, when the glands furnishing these secretions are excited by momentary mental impressions. Another proof of the influence of the nerves on secretion, is the ceasing of the secretion of the gastric juice when the par vagum is divided. Sir B. Brodie's experiments, also, have demonstrated that, when the *vagus* and *nervus sympatheticus* are both divided, arsenious acid does not produce the copious secretion in the stomach and intestinal canal which usually follows its administration. The division of the spinal cord in the loins causes the urine to become limpid like water; whilst the depressed influence of the nervous system, in acute diseases, causes dryness of the mucous membranes and the skin: both are proofs of the influence of the nerves on secretion.

All the medicinal agents, which operate on the excretory ducts of secreting organs, must be such as can exert an excitant power; but every excitant will not effect, indiscriminately, in the same degree, the whole of the excretive organs of the secerning system. Thus, if turpentine be taken into the stomach, in moderate doses, its influence will be most apparent on the *kidneys* and other *urinary organs;* that of mercury upon the *salivary glands;* of antimonials upon the *cutaneous exhalants;* and of squill on those of the *bronchial tubes.* Their action is, also, much modified by the extent of the dose, and by the condition of the body at the time. As the primary action of every medicine exerting an exciting power is at first local, if the dose be very large, so as to stimulate powerfully the tissue with which it is placed in contact, its operation is confined chiefly to that tissue, and the secondary effect, on some distant organ, which should follow *small* and *repeated doses* of the remedy, is not perceived. Thus, if spirit of turpentine be administered in doses of *six* or *eight* fluid drachms, it operates as a purgative, and never reaches the kidneys. By affecting powerfully the motor nerves of the intestinal canal, it increases the movements of that organ, and is hurried so rapidly through it, that none of it is absorbed and carried into the circulation, which must necessarily take place before it can arrive at the kidneys. Mercury in large doses, again, stimulates the excretory ducts of the liver in the duodenum, bringing down so much bile that it operates as a cathartic also, and prevents the absorption of the remedy; whilst antimonials, in extreme doses, operating solely as counter-irritants on the mucous membrane, suspend absorption, and, consequently, display no action on the cutaneous exhalants, or, in other words, no diaphoretic effect.

As the influence of every excitant that operates on a secerning organ, augments the activity of the organ, it is evi-

dent that the effect of all medicines possessed of this property is to stimulate the activity of the gland, or the secreting follicle, and to augment the secretion, causing an evacuant result; and, consequently, although excitement be the first effect of the action of this group of remedial agents, yet the secondary effect is that of an opposite kind. On this account, it becomes important to regulate the action of such excitants, and to keep them within certain limits. If the object be to stimulate topically, and to produce motion at the same time that secretion is augmented, the strength of the excitant, or its dose, must be adequate to both effects; as that which is efficient on the motor nerve, is necessarily abstracted from the nerves connected with the secerning function: when the latter only is required, the excitement must be kept within more defined limits. Although the secretion is at first augmented in quantity by the action of an excitant, this occurs only within a certain limit of the stimulant action. If it approach to or reach near that of inflammation, the state of increased action diminishes, and the secretion is altered in quality. When the secreting organ becomes relaxed, the secretion becomes watery and copious; when the tissue is thickened "by the deposition of the products of inflammation, the secretion formed by it is very scanty*." When the quantity of one secretion is augmented, it always tends to diminish that of another; it is chiefly upon this antagonism, that the salutary influence of the substances which we are about to treat of depends. In noticing this law, however, we should be aware that the secretions must be of an opposite kind; for sympathy operates upon secreting organs, so that increased action in one augments action in all of the same kind; but those of opposite tissues antagonize one another. Glands sympathize with other organs:—thus, the liver sympathizes with the brain; the mammæ with the uterus; the testicle with the parotids; the kidney with the stomach; and it is from a knowledge of this fact, that, on the occurrence of vomiting, in conjunction with acute pain in the kidney, we are enabled to ascertain the presence of a calculus impacted in its pelvis or its ureter.

Some curious and important facts are connected with the influence of rest, age, sex, climate, health, and disease, on the functions of glands; and, consequently, on the influence of medicines acting on glands.

Rest seems necessary for the function of secretion to be perfectly performed: and this is not confined to man and the warm-blooded animals, but it extends to insects. It is well known that bees, before swarming, suspend themselves for days like a curtain before the hive; the intention of which, as Huber ascertained, is a greater than usual secretion of wax for the

* Muller's Elements of Phy. Trans. p. 479.

foundations of the combs of the new hive. When they first form this curtain, the wax pockets of the bees are empty; but if a bee be caught when they take their flight, before beginning to work in the new hive, the wax pockets are more turgid with wax than at any other time.

With respect to *age*—in the fœtus, the liver and the kidneys are comparatively larger than in the adult; they are also more separated into lobes, and more largely supplied with blood; but yet they possess no activity, scarcely exerting any secreting power until after the birth of the infant. After birth, the kidneys secrete a large quantity of urine, and the lachrymal gland, which is excited at this period of life by every passion, secretes tears. In adult age, the testicles, which were inert in boyhood, become active: in females, the mammæ swell, and the nipple becomes erectile on the slightest touch. From thirty to forty years of age and upwards, in both sexes, the liver is in great activity, and those diseases which are termed bilious are most common. It is true that mental affections of a distressing kind, such as ambition, hatred, jealousy, tend to induce an irregular action in the liver: but, independent of these mental influences, age powerfully affects it. The salivary and the mesenteric glands are frequently diseased, and the spleen and the kidneys become more liable to take on a morbid action as life advances; in old age, the glands become hard, and the secretions are altered; the action of some glands, as the testicles, the mammæ, and the uterus, cease; whilst that of others—as, for example, the mucous glands—is greater than ever; hence the rheums and catarrhs of old age. The secretions also become more sapid and odorous; and communicate these properties to the glands.

Sex, even independent of those glands which characterize the sexes, influences glandular secretion: in women the lachrymal glands are more easily excited than in men; women consequently weep more frequently, and for slighter reasons, than men.

Climate influences glandular secretion: it is more regular and active in temperate climates than in either very cold or very warm regions of the globe.

Season also influences secretion: that of the cutaneous system is increased in summer, whilst that of the kidneys is diminished; and, in winter, the cutaneous excretories are, as it were, shut up, whilst the action of the kidneys is augmented, and the quantity of urine increased.

It is almost unnecessary to remark, that, during health, the functions of the secerning system are uniform and regular; but disease varies them in a thousand forms, and destroys the organization of the glands themselves. In hysteria, the kidney being affected, the urine is limpid; yet, as soon as the paroxysm is

over, it returns to its natural state: in epilepsy the saliva is more abundant, yet it is thicker and more frothy than it is in a state of health: and some glands, in a diseased state of the habit, are excited by every change in the system, both corporeal and mental. In disease, also, one gland has its secretion sometimes augmented at the expense of another: in the same state, great local and even general excitements diminish glandular activity: thus, in extensive ulcerations, and in dropsy, it is asserted that the system is affected by mercury with great difficulty: but my experience is contrary to this opinion.

With respect to the secretions themselves, they have been arranged by chemical physiologists according to the substance most predominant in each secretion; thus, Dr. Bostock arranges the perspiration and pulmonary exhalation under the head of *Aqueous;* the membranous parts of animals under *Albuminous;* and the saliva, gastric juice, tears, and semen, as *mucous* secretions. He has also formed classes of *gelatinous, fibrinous, oleaginous, resinous,* and *saline* secretions. It is not my intention to criticise this or any other arrangement of secretions. The excreted fluids are, generally speaking, of a more compound nature than those which are retained for the purposes of the system. According to Berzelius, they all contain a free acid, the *lactic;* and in the urine this is united with the *uric.* Urine, he remarks, contains only a single peculiar characteristic matter; but milk has three; i. e. butter, curd, and sugar of milk: which, however, seem to be produced by different organs, that mingle their fluids in the same receptacle. "The perspired fluid appears to have no peculiar matter, but to be a very watery liquid, with scarcely a vestige of the albumen of the blood; and, in short, is the same as all the other excretory fluids would be, if deprived of their peculiar matter." To proceed further with these remarks is unnecessary: I have only to add that, whatever is the cause of secretion, or whatever the nature of the secreted fluid when once separated from the blood, it cannot be again introduced into it without being productive of disease and danger. Bichat injected bile into the jugular veins of a dog, and found that it quickly proved fatal: he also injected urine into the same vessel; the dogs were rendered ill, but did not die. When the secretions are reabsorbed, the same striking effects do not follow, but the health is impaired. Now, the question may be asked, what is the application of this information to our subject—the operation of Vital Agents, as remedies, on the secerning system? One answer only can be given, that which must naturally suggest itself; that the action of no agent upon the animal body can be correctly understood without a knowledge of the functions of the part to be acted upon, as well as of the qualities of the agent to be employed. To illustrate this by an example—suppose a patient, in whom the complexion is sallow, the albu-

ginea of the eye tinged with yellow, the urine of a deep orange colour, the pulse labouring, and the mental faculties oppressed: I conclude that some cause has either obstructed the excretion of the bile, or that this secretion has overloaded the biliary ducts, and is again absorbed into the circulating mass. How is this to be overcome? If I know that, by stimulating the orifices of the gall-ducts, I shall not only excite that action in these canals which is necessary to empty them of their immediate contents, but also communicate a new action in the gland itself—which, by the increased activity of its secreting powers, will produce a thinner or more fluid bile, less likely to remain in the ducts, and better adapted for the ultimate purposes of the economy—and if no pain be present to indicate that the obstruction is a biliary calculus, I can proceed with a rational expectation of success in relieving the disease. It is upon this knowledge also that is founded the theories of the modus operandi of eight of the orders of remedies in this class of our arrangement.

To influence the secretions, medicinal agents must exert an excitant power; but every stimulant will not affect, indiscriminately, the whole of the secerning system. Thus, if turpentine be taken into the stomach, its operation will be most apparent on the kidneys and urinary organs; if mercury be introduced into the system, the salivary glands show most decidedly the extent of its action; and, if the remedy be an antimonial, it is upon the cutaneous exhalants that we expect it to operate. This action is also much modified by the extent of the dose; for, as the first effect of every stimulant is local, if the dose be sufficiently large to stimulate locally to a certain extent, the result is seldom that secondary effect which is the consequence of smaller and repeated doses of the remedy. Thus, if turpentine be given in doses of six fluid drachms or a fluid ounce, instead of twenty or thirty minims, the kidneys and urinary organs are not affected, because the remedy, stimulating powerfully the motor nerves of the intestines, is carried through the bowels without being absorbed, and never arrives at the kidney: and the same is the effect of mercurials and other excitants; which, in moderate doses, pass into the circulation and operate on particular glands, or generally on the secerning organs.

As the effect of every stimulant which operates on glands secreting an excrementitious fluid is to increase the activity of the gland, it is evident that the effect of every stimulant of this description must be evacuant; and, consequently, although excitement be the first result of the action of such remedies, yet their secondary effect is undoubtedly that of an opposite kind.

SECTION XII.

ERRHINES—MEDICAMENTA ERRHINA.

Syn.—Sternutatories.

Errhines are substances the application of which to the pituitary membrane of the nostrils causes an increased discharge of the natural mucous secretion of that membrane; and also that lining the frontal, the sphenoidal, and the maxillary sinuses. Errhines, also, occasionally affect the lachrymal gland, and excite a copious excretion of tears. They were formerly called Apophlegmatica, and, when they caused sneezing, Ptarmica.

The pituitary membrane* being the organ on which Errhines exert their influence, it is necessary, in order to understand the nature of their action, to enquire in what manner the natural secretion of the nostrils is effected. It is differently organized in its various parts. It is continuous with the skin, and resembles, in part, this general integument. It is composed of two layers, the exterior-mucous, the interior-fibrous; it is the former only that has any analogy to the skin; the interior being, in fact, merely the periosteum of the nasal bones and cavities. The exterior resembles the skin in its structure; it consists of a very evident *chorion*, about the thickness of that which covers the gums and the palate, serving to support a net-work of exhaling and absorbing vessels, blood-vessels, and nerves, and is covered with an extremely thin and delicate epidermis. In the nostrils, and especially where this membrane covers the turbinated bones, it is softer, thicker, redder, and consequently more vascular than in the sinuses, where it is covered by a more limpid secretion than in the nostrils, which are the principal passages of the air which we breathe, and which, consequently, require to be kept constantly refreshed with moisture: the mucous secretion is supplied by follicles, the simplest of all glands. The supply is required to be constant; as it is intended as a protection to the surfaces which are exposed to the influence of external agents; and, in the healthy state of the body, it is of a certain spissitude, and bland in its nature; after some time, however, it thickens, concretes, and, irritating the sensitive surface of the membrane, requires to be removed; for, although this fluid is secreted in the membrane, yet, after its aqueous particles are evaporated by the constant passage of the air through the nostrils, it may become as great a source of irritation to the mem-

* This membrane is also named Schneiderian, after a distinguished anatomist of the 17th century, whose work, "De Osse Cibriforme et Sensu ac Organo Odoratus," published in 1665, put an end to the absurd doctrine that this membrane is an emunctory of the brain.

brane as if it were an extraneous body. Substances, whatever their nature, which augment this secretion beyond its natural quantity, are Errhines.

Every excitement of the mucous surface produces a corresponding increased action in the glands, which are situated beneath it, and the ducts of which open upon it; for the irritating matter is not applied to the glands themselves, but to their excretory ducts; and this effect in the nostrils is only in accordance with the law which regulates the whole glandular system—that the susceptibility of the gland always corresponds to the irritation of its excretory ducts. Thus we find that the irritation of the mucous membrane of the nostrils stimulates the excretory ducts of the secreting follicles, and not only increases the flow of the natural mucus, but produces a thinner and more acrid secretion than that which is more slowly and naturally secreted.

Every unusual excitement causes in the pituitary membrane a state of vascular action approaching to inflammation; and when this extends beyond a certain degree, actual inflammation is produced, which for some time contracts the excretory ducts of the glandular cullender, "les couloir glanduleux*," and stops the secretion. This is obvious in the commencement of catarrhal affections: the nostrils become dry, and it is a symptom of the resolution of the inflammatory action in the part when the nostrils begin to discharge freely. It is probable that these membranes are more susceptible of inflammation than other mucous surfaces, from their constant exposure to the action of the atmospheric air in every act of inspiration. The vascular webb, if I may apply such a term, which is spread over them is full of blood, and, being separated from the air only by a very thin pellicle, the membrane is always red. It is not improbable that it derives this colour, as Bichat has suggested, from its either separating a portion of the carbon of the blood or absorbing oxygen; or, as more modern physiologists suppose, from the alkaline character of the secretion: thus, in a certain degree, acting as an accessory to the lungs. Be this as it may, the red colour of the pituitary membrane depends on the abundance of arterial blood with which it is supplied; and it is the increased action of the minute vessels containing it, to a degree short of positive inflammation, which augments the secretion of the mucous follicles and the consequent flow of the mucus. In the adjoining communicating sinuses the membrane is thin and supplied with few arterial vessels; but it is covered with vessels of a peculiar nature, that exhale a watery vapour, which, condensing, is poured into the nostrils, in every position of the body. This affords the very copious watery discharge from the nostrils in catarrh, amounting in some cases to several fluid

* Bichat.

ounces in the course of a day: it is from the same portion of this membrane, also, excited by its continuity with that part of it which covers the nostrils, when stimulants are applied to them, that the greater part of the discharge caused by the use of Errhines is derived.

All excitants act by the impressions which they make upon the nerves. Now, as the first pair of nerves is spread upon the membrane covering the septum of the nostrils and the turbinated bones, it is reasonably supposed to be the nerve of smelling. It does not terminate in papillæ like the gustatory nerve; but its twigs deliquesce, as it were, in the spongy pituitary membrane, and consequently render every point of it sensitive of odours. From its exposed nature rendering it liable to irritative impressions, we might, a priori, suppose that those substances which are most odorous would prove the most powerful Errhines: but this is not the case: some of the most powerful Errhines are altogether devoid of odour. This is readily explained: although the first pair of nerves bestows the sense of smelling, yet the excitability depends upon branches from the fifth pair distributed on the Schneiderian membrane, both in the nostrils, and in the sinuses where none of the twigs of the olfactory nerves extend. It is the impression of Errhines upon the filaments of the fifth pair that induces the augmented secretion, and the consequent discharge from the nostrils and the adjacent cavities. Pungent odours, it is true, increase the flow of the pituitary secretion; but their acrimony irritates the mucous membrane of the nose, upon the same principle as it irritates the conjunctiva, or outer membrane of the eye, when it is exposed to such odours—an effect altogether independent of the odorous principle, which is perceived through the medium only of the first pair of nerves. Were the first pair of nerves, therefore, destroyed, as in some experiments made by M. Majendie, pungent odours would still affect the nostrils, although no odour would be perceived*.

It is almost unnecessary to say that inflammation augments greatly the sensibility of the pituitary membrane; and the application of acrid matters to it, in such a condition, is not only painful, but in some degree dangerous. It is, nevertheless, true that habit exerts its influence in modifying the impressions upon this organ more than upon any other; many impressions which are at first not merely unpleasant, but painful, become pleasurable by repetition; so that an Errhine—snuff, for example—at length, from this cause, loses the power of exciting either vascular action or sensation. It is singular, however, that age, which renders the pituitary membrane less vascular and less sensible, should not in general diminish the secretion of the mucous follicles;

* The want of attention to this particular led the French physiologist into an error in attributing the sense of smelling to the fifth pair of nerves.

on the contrary, the mucous discharge increases as age advances, and constitutes a chronic catarrhal affection, or snivelling, which is not uncommon in the last years of a long life.

Sympathy exerts a considerable influence upon the pituitary membrane. If hæmorrhage occur in it, cold applied to the skin of the neck contracts the exhaling overloaded vessels of the membrane and stops the bleeding. In inflammation of this membrane, also, fomentations applied to the face allay the excitement; and, in some diseases of the skin—for example, scarlet fever in its severest form—this membrane becomes inflamed and ulcerated.

With regard to the nature of the discharge which the pituitary membrane secretes, the experiments of Berzelius have ascertained that the ingredients in one thousand parts are

Water	933·7
Mucus	53·3
Chlorides of Potassium and Sodium .	5·6
Lactate of Soda with Animal Matter .	3.0
Soda	0·9
Albumem, with a trace of Phosphate of Soda	3·5
	1000·0

It thus appears that the chief ingredients are water and mucus; yet, in disease, the secretion is so much altered, that it becomes grey and green, and so acrid as to excoriate the upper lip, and to taste saline. That this arises from the action of the vessels, and not from any alteration in the components of the blood affording the secretion, is probable, when we reflect that the greatest changes are produced by the inflammatory process in other mucous membranes; the discharge sometimes assuming the character of pus without any abrasion of the mucous surface. In ordinary health, the viscidity of this mucus seems to depend on the evaporation of the watery portion; hence, in hurried states of the respiration, the nostrils become dry and the mucus viscid and concrete.

From a knowledge of these functions of the pituitary membrane, we perceive clearly that the effects of Errhines result from their increasing the natural vascular action of the part within a certain limit; and we learn, also, that beyond that limit, instead of promoting the flow of a watery discharge from the nostrils, they tend to check it, by causing inflammation: hence the necessity for moderating the acrimony of Errhines by uniting them with inert powders. We can also more readily comprehend the manner in which Errhines relieve inflammatory affections of the brain, the face, and other adjacent parts, for which they are chiefly employed as remedies. And, with this knowledge, we arrive at these conclusions:

1°. That Errhines are stimulants acting immediately upon the sensibility and irritability of the Schneiderian membrane:

2°. That they relieve inflammation in the neighbouring organs, partly by the counter-irritation which they produce, causing an afflux of fluids from the neighbouring congested or inflamed parts into the excited membrane, and partly by the permanent diminution of the quantity of the blood, caused by the augmented secretion which is induced and the continued emptying of the mucous follicles. To elucidate this position, let us suppose an instance of ophthalmia, or inflammation of the eyes: there can be no difficulty in conceiving that in this case the diseased organ is as likely to be relieved by exciting an artificial discharge from the nostrils as by a blister behind the ear, or on the temples, or by any other counter-irritant.

The first effect of several substances employed as Errhines is the excitement of sneezing, an act which is caused by irritating the sensitive extremities of the branches of the fifth pair of nerves distributed to the pituitary membrane, which, by the connection of that nerve with the eighth pair, the great sympathetic and the phrenic nerves, calls into sudden simultaneous action the diaphragm and the whole of the respiratory muscles, after a full inspiration, the consequence of which is the forcible expulsion of air from the lungs through the mouth and nostrils. It tends to clear the nostrils of concreted mucus, and so far is productive of benefit; but in some cases it is productive of serious mischief. Thus, in reference to the benefit likely to result from sternutatories, a lady who was afflicted with violent headache, accompanied with that sensation which is termed stuffing of the head, had tried many means for her relief without benefit. A physician was called in, who prescribed snuff as a sternutatory: it produced violent sneezing, and ejected from one of the nostrils a plug of hardened mucus, nearly an inch in length; after which she felt immediate ease, and in twenty-four hours was perfectly recovered. On the other hand, in a young lady, who had an affection of the ethmoid bone, an attack of sneezing in a few hours proved fatal. Many instances, also, are recorded in which sneezing has produced immoderate bleedings from the nose, epileptic fits, and apoplexy; and, consequently, those errhines which were formerly regarded as sternutatories are now seldom prescribed*.

* The following singular fact came under my observation. A lady, liable to periodic attacks of gout, was always apprized of the approach of the paroxysm by successive fits of sneezing, which generally continued for ten or twelve hours previous to the commencement of the attack, and terminated when the pain was felt in the foot. I can account for this circumstance only by supposing that the gouty diathesis so altered the usual state of the pituitary membrane as to render it susceptible of the impressions even of the air; and hence it is possible that, although the mucous follicles are not excited sufficiently to enable them to empty their contents, yet, the passage of the air, in a highly irritable state of the membrane, may induce the paroxysm of sneezing, previous to the attacks of gout.

Although every substance that can stimulate the pituitary membrane may be used as an errhine, yet, few are employed; and to these only it is necessary to direct attention. They may be used either in the state of fine powder, or in infusion, decoction, or vapour.

TABLE OF ERRHINES.

* ORGANIC PRODUCTS.

a.—VOLATILE OIL, in combination in
  Herbs —Origanum *Marjorana*. 14 . 1 . Labiatæ.
  Leaves —Asarum *Europæum*. — . – . Aristolochiaceæ.
  Flowers—Lavandula *vera*. — . – . Labiatæ.
    Rosmarinus *Officinalis*.— . – . ————
b.—ACRID RESIN, contained in the secreted juice of
    * Euphorbia *Canariensis* 11 . 3 . Euphorbiaceæ.
    ———— *officinarum*.
c.—NICOTINA, in
    Nicotiana *tabacum*. 5 . 1 . Solanaceæ.
d.—VERATRIA, contained in
    Veratrum *album*. 23 . 1 . Melanthaceæ.

* * INORGANIC SUBSTANCES.

e.—Hydrargyri oxydum sulphuricum.

* ORGANIC VEGETABLE SUBSTANCES WHICH OPERATE AS ERRHINES.

a. VOLATILE OIL. *Oleum Volatile.*—On account of the solubility of volatile oil in air, the plants containing it might be supposed to be well adapted for stimulating the pituitary membrane; but, in these, the oil is so much sheathed, that it does not exert the necessary influence on the secreting surface of the nostrils; therefore, most of these plants are better adapted as vehicles for more efficient errhines, than for exerting errhine properties themselves.

* *Herbs and Leaves.*

1. SWEET MARJORUM. *Origanum Marjorana.* D.—This plant, which belongs to the natural order Labiatæ*, although a native of India, Syria, Greece, and Portugal, yet is now naturalized to our variable climate: it has a strong but agreeable odour, and a warm, bitter, aromatic taste, depending on the volatile oil which it contains, and which is retained in the dried plant. It

* Woodvilles's Med. Bot. third ed. p. 346, pl. 124. London Dispensatory, art. Origanum. Richard, Hist. Nat. Med. t. ii, p. 57. Hayne, viiii. 9.

possesses slight errhine properties; and is chiefly useful as an agreeable addition to the compositions termed cephalic snuffs.

LEAVES OF ASARABACCA. *Asarum.* L. *Asari folia.* D.—Asarabacca, Asarum *Europæum,* is an indigenous plant, found in mountainous woods and shady places, flowering in May. It belongs to the natural order Aristolochiaceæ*. It is a small plant, with creeping roots, and short round stems, each bearing two reniform, dark green, shining leaves. The flower is solitary, drooping, fleshy, and lurid. Besides volatile oil, it contains an acrid fixed oil, and a peculiar principle termed *Asarin,* besides a substance resembling an extract, of a dark yellow colour, bitter, nauseous, and attracting humidity from the air. *Asarin* is in pearly crystals, resembling camphor in taste, and volatilizing at 212° in acrid vapour. It is very soluble in water and in weak alcohol; and nearly insoluble in strong alcohol and in ether. It possesses neither acid nor alkaline properties; is not precipitated by those tests which usually affect vegetable products, namely, the acetates of lead, the nitrates of silver and of mercury, the sulphates of copper and of iron; nor by the chlorides of barium, calcium, tin, and strontian. With tincture of galls it forms an insoluble tannate. Notwithstanding these negative properties, Asarin acts with violence on the animal œconomy, producing vomiting, purging, and inflammation of the intestinal canal.

M. J. L. Lassaigne and M. Feneulle, who analysed the roots of Asarabacca, state its contents to be—1. a concrete volatile oil, apparently camphor; 2. an acrid fixed oil; 3. Asarin; 4. fecula; 5. gum; 6. ulmin; 7. critic acid, besides citrate of lime and malate of lime; 8. an acetate; 9. a salt with an ammoniacal base and some mineral salts. Several of these substances are not found in the leaves. In the decoction, persulphate of iron detects the ulmin by throwing down an olive-coloured precipitate; the gum is rendered evident by diacetate of lead; but no fecula is detected by iodine: Asarin is demonstrated by infusion of galls; and the salts of lime by oxalate of ammonia. The taste and odour of the plant undoubtedly depend on the acrid fixed oil, which both tastes and smells like pepper; on which account, the Errhine properties of this plant is probably due to the volatile and acrid oils. Be this as it may, Asarabacca is a good Errhine. In the recent state of the plant, it operates too powerfully, inducing not only a greatly augmented mucous discharge from the nostrils, but frequently a discharge of blood. It loses much of its acrimony by keeping; but it retains enough for the purposes of an Errhine: heat dissipates the volatile, and

* Woodville, p. 170, pl. 66. London Dispensatory, art. Asarum. Richard, t. i, p. 433. Hayne, 1. 44. Lindley, 344.

M. Thiebaud, of Berneaud, and M. Tenore have recognized the *Baccaris* of Virgil, which was formerly used in making crowns, to be this *Asarum:* it is found in great abundance in all the mountainous districts in Italy.

alters the fixed, acrid oil; on which account the plant should be dried without the aid of fire.

Dr. Cullen has justly remarked that Asarum is one of the most useful and convenient of the Errhines. The effect is not immediate, but takes place after some time has elapsed.

COMPOUND POWDER OF ASARABACCA. *Pulvis Asari compositus,* D. is made by pulverising together ℥i of the dried leaves of Asarabacca, and ʒi of dried lavender. In doses of a few grains, snuffed up the nostrils, for several successive evenings, it causes a copious watery discharge from the nostrils, which continues to flow for several days together.

* * *Flowers.*

LAVENDER FLOWERS. *Lavandula.* L. E. D.—The plant yielding these flowers is the Lavandula *vera,* not L. *spica* as stated in the London and Dublin Pharmacopœias. It is a native of the south of Europe, naturalized to our climate: and belongs to the natural order Labiatæ*. The plant rises about 1 and 2 feet high, with oblong, linear, entire revolute leaves, hoary when young. The flowers are blue in interrupted spikes, of 6 to 10 whorls, with scarcely any bracts; they blow from July to September. The odour is fragrant and most agreeable, and retained in the dry state of the flower; the taste bitter, aromatic, somewhat resembling that of camphor. On account of the fragrancy of their volatile oil, the flowers enter into the composition of cephalic snuffs.

2. ROSEMARY. *Rosmarinus.* L. E. D.—This plant is also one of the Labiatæ†. It is a native of the Levant, but has been naturalized to our climate. It is an evergreen, rising from 3 to 4 feet, bearing axillary racemes of bluish white flowers in April and May, with sessile, linear, entire leaves, revolute at the edge and hoary beneath. It possesses excitant and tonic properties, due to its volatile oil, and is sometimes prescribed, in the form of infusion, to relieve headache and hysteria. It is an agreeable addition to cephalic snuffs.

c. ACRID RESIN, found in the genus Euphorbiaceæ.

EUPHORBIUM. *Euphorbium.* L. E. *Gummi Resinæ, Euphorbiæ Canariensis.* D.—Euphorbium is the concrete proper juice of several species of Euphorbia. The Euphorbia *Canariensis* of the Dubin College answers best to the parts of the plant found mixed with the Euphorbium of commerce. The plant belongs

* Woodville's Med. Bot. 3d edit p. 321, p. 114. London Dispensatory, art. Lavandula. Richard, Hist. Nat. Med. t. ii, p. 45. Lindley, 485. Hayne, viii, 37, under the name L. *augustifolia.*

† Ibid, p. 329, pl. 117. London Dispensatory, art. Rosmarinum. Richard, Hist. Nat. Med. t. ii, p. 29. Lindley, 489. Hayne, vii. 25.

to the natural order Euphorbiaceæ*. In the London Pharmacopœia it is improperly stated to be the product of the Euphorbia *officinarum;* for, although the proper juice of this species, as well as that of all the species of this very extensive genus, is nearly the same, yet the Euphorbium brought to this country is supposed to be the product of the *Canariensis*†. It is, as its name implies, a native of the Canary Islands. It rises with a straight, articulated, quadrangular stem, which gives off lateral, similarly jointed branches, devoid of leaves, but furnished with double-hooked spinous prickles on the angles: the *officinarum* has eight or more angles. There is, however, no certain information regarding the species which yields the Euphorbium of the shops.

. With regard to the manner in which the juice concretes into the forms in which it is sent to this country, there are various opinions. Bruce, in his Travels in Abyssinia, describes the *officinarum* under its Abyssinian name, Kollquall. In speaking of the flowers, which shoot out on the tops of the branches, he says, "The trees, that stood thick together, appeared to be covered with a cloth or veil of the most vivid crimson colour." He remarks that, on cutting two of the finest branches of a plant in full vigour, four English gallons of the milky juice issued from the cut surfaces, and made an indelible stain upon his sabre, although he immediately washed it. On striking a withered branch, the dust which flew out "seemed to threaten," he says, "to make me sneeze to death;" and touching the milky juice excoriated his finger as if scalded with boiling water. He denies that the juice ever exudes spontaneously; and, therefore, justly concludes that this is not the plant which supplies the Euphorbium for Europe. Mr. Jackson says that slight incisions are made into the plant with a knife, and the juice that exudes concretes into tears of an oblong or roundish form. On examining the form of the pieces in the Euphorbium brought to this country, I am of opinion that the juice must exude spontaneously from the plant; for it is almost all of the same form, as if it had been moulded upon the capsules and spines, which are often found imbedded in the Euphorbium. It is in small, hollow, somewhat forked pieces; inodorous; and, when chewed, at first nearly insipid, but soon impressing a hot sensation to the mouth, and gradually giving to the tongue, the palate, throat, and pha-

* Woodville's Med. Bot third edition, vol. v, p. 74. London Dispensatory, art. Euphorbia. Richard, Hist. Nat. Med. t. i, p. 575. Nees Von Essen. 134. Lindley, 192

† The name was bestowed on the genus in honour of Euphorbus, the physician of Juba, king of Lybia. The brother of Euphorbus, Antonia Musa, was physician to Augustus Cæsar, who raised a statue to his merits. In noticing this anecdote, Linnæus quaintly remarks on the evanescent character of the productions of art, compared with the permanency of those of Nature: Ubi jam Musæ statua? Periit! avanuit! Euphorbii autem perdurat, perennat, nec unquam destrui potest." *Crit. Bot.* 39.

rynx, an acrid or burning feeling, which is almost insupportable. When retained for some time in the mouth and masticated, it inflames, corrodes, and ulcerates.

Euphorbium has been analysed by Braconnot, Pelletier, and Brande, who have found the same substances, although in different quantities. The products of the analysis and the quantities given by each are—

	Braconnot.	Pelletier.	Brandes.
Resin	37·0	60·80	43·77
Wax	19·0	14·40	14·93
Malate of lime . .	20·5	12·20	18·82
——— of potassa . .	2·–	1·80	4·90
Woody matter and bassorine	13.5	2·00	5·60
Water and volatile oil .	5·0	8·00	
Loss	3·–	—·80	6·44
Caoutchouc and salts .			5.54
	100·0*	100·0†	100.00‡

Euphorbium melts in a moderate heat, and in a greater burns with a bright flame, emitting an odour not unlike that of Benzoin. When alcohol is boiled upon it and filtered, a quantity of wax is deposited on cooling, and resin remains in solution. The wax, when well washed with alcohol, is insipid; the resin is acrimonious, and burns when applied to the tongue. The insoluble residue, when acted upon with pure water, independent of waste from morsels of wood and other extraneous bodies, is mostly malate of lime. The resin is slightly deliquescent, owing to its containing malate of potassa, which can be separated from it by boiling it with distilled water: when pure, it is transparent, reddish, idioelectrical when rubbed; and is the active part of Euphorbium. This resin is insoluble in alkalies, but soluble in sulphuric and nitric acids; hence it differs from most other resins.

Euphorbium, applied to the skin or to the mucous membrane, quickly produces the most painful and violent irritation. It is so acrid, that those who pulverize it are obliged to defend the nostrils, the eyes, and the mouth. Orfila, who made numerous experiments on dogs with it, found that, by applying it to the thigh of a dog denuded of the cuticle, it produces so intense an inflammation in the part, extending to the adjacent parts, as to cause death; but, on opening the body, neither the lungs nor the primæ viæ presented any marks of having suffered. It is a powerful Errhine, causing a bloody discharge when snuffed up the nostrils: it requires, therefore, to be largely diluted with some bland powder, either starch or liquorice-root powder; in which state it operates effectually and beneficially; and may be used as an errhine in chronic ophthalmia.

* Ann. de Chim. lxviii 44. † Bull. de Pharm. iv, 502. ‡ Gmelin, Handb. d. Chem.

NICOTINA and NICOTIANIN, contained in the dried leaves of Tobacco.

TOBACCO. *Tabacum.* L. E. *Nicotiana Tabacum.* D.—Tobacco has been already described (p. 308), as well as the peculiar alkaline principle named *Nicotina*, to which it owes much of its efficacy.

Every part of Nicotiana *Tabacum* is acrid, and contains the active principles for which the leaf is prized. It is, however, cultivated for the leaf, to promote the development of which the plant is never allowed to flower.

In Virginia, the Tobacco is gathered in August, before it flowers, when the leaves have attained their full size, and have a dark green colour, and feel crisp. The plants are cut over at the surface of the ground, and suspended under an open shed, two and two, tied together, but sufficiently apart from each other so as not to touch. In this state they remain until they are perfectly dry; when the leaves are stripped from the stalks and tied in small bundles, a leaf serving to tie them together. These bundles are then laid in heaps, in sheds, to favour fermentation; and, to forward it still more, the heaps are covered with blankets or layers of straw. They are, however, occasionally opened and spread abroad in the air, to prevent them from overheating; and, as soon as all danger of this is past, the bundles are packed in casks for exportation to Europe.

Dried Tobacco leaves have a brownish-yellow colour; a strong and not very agreeable odour; and a bitter, acrid taste. When burned, they emit sparks, and continue to burn like paper which has been soaked in nitrate of potassa; on which salt, indeed, the deflagration of Tobacco depends. Distilled, without the addition of water, they yield a green volatile empyreumatic oil, which is a virulent poison. At the Cape of Good Hope and Van Dieman's Land, this oil, accumulated in the tubes of old smoking pipes, is employed for killing snakes. "A Hottentot," says Mr. Barrow, "applied some of it, from the short end of his wooden tobacco pipe, to the mouth of a snake, while darting out his tongue. The effect was instantaneous as an electric shock: with a convulsive motion that was momentary, the snake half untwisted itself, and never stirred again; and the muscles were so contracted that the animal felt hard and rigid, as if dried in the sun." Tobacco yields its properties to water and to alcohol. The expressed juice of the fresh leaves, analysed by Vauquelin*, were found to contain a considerable quantity of vegetable *albumen; supermalate of lime; acetic acid; nitrate of potassa* and *chloride of potassium;* a *red matter*, soluble in alcohol and water, which swells considerably when heated, but the nature of which is unknown; *hydrochlorate of ammonia;* a peculiar, acrid, volatile, colourless, alkaline substance, *Nicotina*, which has the odour

* Ann. de Chim. lxxi, p. 139.

of Tobacco, and is the principle that distinguishes it from every other vegetable product, chlorophylle, and woody fibre. In a subsequent analysis by Possett and Reinmann*, besides the above, *malic acid*, *bitter extractive*, *starch*, and *nicotianin*, a concrete volatile oil, were procured. Some of these principles are detected in infusion of Tobacco by reagents: thus, the gluten is precipitated by infusion of gall-nuts; oxalate of ammonia decomposes the supermalate of lime, and throws down an oxalate of lime. That the salt is a malate, is proved by the persulphate of iron precipitating a brown malate of iron. Nicotianin was detected by Hermbstadt, in 1821. It separates during the distillation of the leaves in water, is concrete, has the odour of Tobacco, and a bitter acrid taste. It is this principle which excites the sneezing when snuff is taken by one unaccustomed to its use.

The history of the introduction of Tobacco into Europe, and its use as a luxury, is so curious and interesting, that I will make no apology for presenting a brief sketch of it.

There is no record of the period when Tobacco was first used in South America. Humboldt says it had been cultivated from time immemorial by the natives of the Oroonoko; and it was smoked over all America at the time of the Spanish conquest. It was also used in the religious ceremonies of the Indians; the smoke of a few Tobacco leaves thrown upon the fire produced the same effects on the officiating Piachè as the mephitic vapours on the Priestess of Delphos; the smoke was received into the open mouth of the Piachè, who thus became intoxicated, and fitted to utter the mystical jargon which was regarded as oracles by the misguided multitude. Tobacco was found by Cortes in use in Yucatan, in 1519; but it had been seen smoked on the occasion of an amicable interview between Gonsalvo, a Spaniard, and the Cazique of Tabasco, which took place in the previous year. In Asia, where it is now an almost absolute necessary of life, it was unknown until after the discovery of America. It was first sent to Europe, to the court of Portugal, by Hernandez de Toledo, in 1559; and Jean Nicot, being then the French ambassador at the court of Lisbon, having sent some of the seeds to Catharine de Medicis, they grew; and the plant was named Herba Reginæ: it was, however, afterwards called Nicotiana, after *Nicot*. The specific name, *Tabacum*, according to some, is derived from Tabasco†, the name of the place where the Spaniards first saw it smoked; according to others, from Tabac, the name of the instrument or reed used by the Americans in smoking the leaf: the first derivation is the most probable.

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* Gmelin, Handb. d. Chem. ii, 1303.

† Tabasco was indiscriminately called Tabaco.

Although Linnæus honoured Nicot with the generic name of the plant, yet some species were discovered in the island of St. Domingo before 1518, by a Spanish hermit, Roman Panè. It was cultivated before 1580, in Spain, France, Italy, and Portugal; and was introduced into England by Sir Walter Raleigh, who certainly, by his example, and that of his crew, brought smoking into use. It had, however, many opponents, and among them a royal one in James the First, who published a philippic against it, "The Counterblaste to Tobacco," in which he remarks that smoking is a custom "loathesome to the eye, hateful to the nose, harmfull to the braine, dangerous to the lungs; and, in the black stinking fume thereof, neerest resembling the horrible Stygian smoake of the pit that is bottomless*:" a sentiment in which although some might accord, yet from which many would strongly dissent. The same monarch proposed, "as a banquet for the devil, a loin of pork, and a poll of ling and mustard, with a pipe of Tobacco for digestion:" he endeavoured to abolish its use by a heavy penalty, and enacted that no planter in Virginia should cultivate more than 100lbs. of it: but the advantage derived to his revenue soon produced the abolition of these restrictions. An edict had been previously published against its use in the time of Elizabeth, in which the reason for prohibiting it is a fear lest Englishmen should become like the barbarians from whom its use was derived—"Anglorum corpora in barbarorum naturam degenerasse, quum iidem ac barbari delectentur†." But it was not in England alone that war was waged against Tobacco: in the 16th century (1590), Shah Abbas prohibited its use in Persia; but, as the punishment was penal, many of his subjects, rather than discontinue smoking, fled to the mountains. In 1624, Urban VIII excommunicated all who committed the heinous sin of taking a pinch of snuff in church; and in 1653, all smokers in the Canton of Appenzel were cited before the council and punished. In the year 34 of the same century, the Russians, whose peasantry now smoke all day long, were forbidden to smoke under the penalty of having the nose cut off: and Amurath VII also rendered smoking a capital offence. In Russia, indeed, the animosity against the use of Tobacco, in any form, was so great, that a particular tribunal was instituted for punishing smokers, the Chambre au Tabac; which was not abolished until the middle of the 18th century. So late as 1690, Innocent XII excommunicated all who took snuff in St. Peter's; and, in Constantinople, where the use of Tobacco, in every form, is now as common as eating, every Turk who was found smoking was paraded in the streets, with a pipe transfixed through his nose and seated on an ass with his face towards the tail; one reason for which was, that it was

* Apophthems of King James, 1671. † Ann. Eliz. p 143.

supposed the use of Tobacco rendered the men impotent; and, certainly, if taken in excess, such a result is likely to follow from its use. But, like many other bad customs, Tobacco triumphed over all its opponents, and has become almost universal. In the islands of the Pacific, where it was introduced by Europeans, its use is carried to the most ridiculous excess. "In the Sandwich Islands," says Kotzebue, in the narrative of his Voyage of Discovery, "it is so generally used, that children smoke before they learn to walk; and grown-up people have carried the practice to such an excess, that they have fallen down senseless, and have often died in consequence."

But if smoking be carried to an excess, snuff-taking is still more so*. Nothing would be more curious than a collection of snuffs from various parts of the world; and their history would form a singular specimen of the ingenuity idly exercised in varying the form and quality of a powder intended for the titillation of one set of nerves. The snuffs of this country, like the varieties of sheep, may all be regarded as proceeding from one stock; or, as cross breeds, if the term can be tolerated, from the *Rappé*, which is nothing more than snuff ground from all the Tobaccos that are grown, mixed together and fermented. Rappé derives its name from having been originally produced by rasping what is called Carrot Tobacco; that is, the leaves of tobacco freed from their stems, fermented, and pressed closely together in the form of a carrot, or rather a spindle. Scotch snuff, which is also the basis of many varieties of snuff, is ground from Tobacco, with the stalk left on the leaf: it is first fermented, then dried before a strong fire, and afterwards ground in mills resembling a large pestle and mortar. It would be impossible to mention one half of the snuffs in use. In their manufacture, it has been asserted that salt, urine, sal ammoniac, and even ground glass, are added to the Tobacco: but I am informed by a large manufacturer that nothing of the kind is employed, and that all depends on the preparation of the Tobacco leaves, by drying, and the degree of fermentation which they have undergone.

Upon the animal œconomy, Tobacco operates as a local stimulant, and a narcotic; it is the former only that we have now to consider. Applied to the petuitary membrane, it augments the flow of mucus, on those principles which, as I have already explained, regulate the action of Errhines; but, like other stimulants, the repetition of the impression diminishes the sensibility and irritability of the part to which it is applied. Thus, snuff-takers lose the susceptibility of impression on the Schnei-

* An amusing fact, connected with the opposition to the general use of Tobacco, is related of Fagon, physician of Louis XIV. In the midst of an oration on its pernicious effects, the orator made a pause, and, taking his snuff-box from his pocket, refreshed himself with a pinch, to enable him to renew his argument.

derian membrane; and, therefore, are forced to increase the quantity snuffed up at once, as well as the frequency of its application. Snuffing is the most frequent and the least injurious mode of using Tobacco; although, in those unaccustomed to it, it causes nausea and vertigo. In great snuffers, the stomach frequently suffers; dyspeptic symptoms supervene, with pains and a sensation of twisting in the bowels—effects which may result from the snuff passing into the pharynx and being swallowed; although it is also possible that they may proceed from sympathy. Instances daily occur in which quantities of snuff are coughed up by great snuff-takers; and Dr. Alston says that some persons have thrown up balls of snuff*. It is generally injurious in weak and what are termed nervous subjects: some practitioners, indeed, among whom is the celebrated Lorry, have ascribed the more frequent occurrence of nervous diseases to the daily excessive use of snuff; and Dr. Prout confirms this statement, and adds, "I have more than once seen such cases (of dyspepsia from inveterate snuff-taking) terminate fatally, with malignant diseases of the stomach and liver†. Upon the whole, however, it is probable that many of the statements respecting the baneful effects of snuff are exaggerated. In the manufactory of snuff at Strasburg, in France, in which upwards of 4000 persons are employed, it has been ascertained that the workmen become habituated to the atmosphere of the manufactory; that they are neither subject to special diseases, nor to disease generally; and that they live, on an average, as long as other tradesmen.

Tobacco, as an Errhine, has been used in epilepsy supposed to proceed from a plethoric state of the vessels of the head. From the quantity of fluid discharged, a depletion of the whole of the vessels of the head is supposed to result: but, from its narcotic property, it ought to be employed with caution, and not at all when there is any tendency to apoplexy. We certainly, sometimes, see great snuff-takers seized with apoplexy and palsy, when they suddenly leave off the use of snuff. Upon the whole, it is a much less valuable Errhine than several of the substances in this class of remedies.

Veratria, L. E.—an alkaline principle, discovered by Pelletier and Caventou, has been already described (p. 452), as well as the plants which yield it.

Veratria is too energetic to be employed alone as an Errhine; an almost imponderable quantity applied to the nostrils provoking the most violent sneezing. We see, however, in these

* In the Counterblaste already quoted, we find the following sentence on this subject:—"It makes a kitchen, also, oftentimes in the inward parts of man, soyling and infecting them with an unctuous and oily kind of soote, as has been found in some great Tobacco takers that after their death were opened."

† Prout on Stomach and Urinary Diseases, p. 23

properties, a proof that it is the presence of the Veratria which gives the root of White Hellebore, Veratrum *album*, its Errhine properties; and we possess the means of making a certain Errhine, always of the same strength, by combining Veratria with a certain portion of starch sufficient to cover its acrimony. In the powerful action of an inodorous substance, also, when applied to the nostrils, we have a demonstration of the fact, that the action of Errhines is not exerted upon the olfactory nerves, but upon those of the fifth pair, on which the irritability of the mucous membrane depends. Even as it exists in the roots of Veratrum, the Veratria is so acrid as to require farther dilution before it can be employed with safety; the powdered root, therefore, is mixed with three parts of starch, or the powder of liquorice root, for Errhine purposes. Three grains of it, diluted with nine grains of starch, snuffed up the nose for three successive evenings, produce a copious watery discharge from the nostrils. Great caution is required not to apply it to an ulcerated surface; for, besides producing griping and purging, and other poisonous symptoms, the ulceration assumes a phagedenic character.

INORGANIC SUBSTANCES WHICH OPERATE AS ERRHINES.

Subsulphate of Mercury. *Hydrargyri Sulphuricum Oxydum.* D.—This salt is prepared by triturating twenty parts of boiling water with one part of Persulphate of Mercury; pouring off the supernatant fluid, and washing the yellow precipitate with distilled water, as long as the washings display any deposit on the addition of the solution of pure potassa; and, lastly, drying the powder. The hot water poured on this persulphate acts by a powerful affinity for sulphuric acid, and abstracts the greater part of it, precipitating the subsulphate of a bright yellow colour.

This subsulphate is the *Turpeth mineral* of the old chemists: when well prepared, it is of a bright yellow colour, inodorous and acrid; and nearly insoluble in water, requiring 2000 parts at 60° and 600 at 212° for its solution. Its sp. gr. is 6·444. Its constituents are 15·5 of acid; 84 of binoxide; or 1 eq. of sulph. acid = 40·1, + 5 of binoxide of mercury = 218; equiv. 258·1*. It is an extremely useful Errhine, and possesses the property of being always of the same degree of strength. It requires to be sheathed with five parts of starch, or any farinaceous powder; a dose of which, containing one grain of the subsulphate and five

* That it is a subsulphate is proved by exposing it to the action of a solution of pure potassa, which unites with the sulphuric acid, and leaves the binoxide of a brownish-yellow colour. If the solution be separated, acidulated with nitric acid, and tested with nitrate of baryta, the presence of the sulphuric acid is readily detected by the formation of sulphate of baryta.

of starch, snuffed up the nostrils, generally produces a discharge which continues for several days. It has been found very useful in chronic ophthalmic affections; and, as it possesses no narcotic property, it is superior to every other Errhine in affections of the head.

THERAPEUTICAL EMPLOYMENT OF ERRHINES.

In chronic affections of the conjunctiva, Errhines prove useful: but in amaurosis, in which they have been extolled, I have never seen any advantage derived from them: indeed, when we reflect upon the variety of causes that produce this affection of the optic nerve, we can scarcely wonder at their failure. In that species of the disease, however, which Sauvage describes under the name of Amaurosis *plethorica,* which, in particular, sometimes affects females labouring under suppressed catamenia, or proceeds from transitory congestions, they may prove useful. Deafness arising from some states of the Eustachian tube, as, for instance, thickening of its lining membrane, has been relieved by the use of Errhines. The celebrated Boyle reports a case of absorption by the counter-irritation of Euphorbium as an Errhine; but little weight can be given to any solitary case. Errhines have been recommended in chronic affections of the head of a rheumatic character; but there are preferable remedies, which supersede their employment in such diseases. The complaints in which they are most evidently beneficial are headache connected with a debilitated frame of body. In these cases their stimulant properties are beneficial, while, at the same time, by the discharge which they solicit, they prevent congestion from occurring in the weakened vessels of the brain. Upon the whole, Errhines are not remedies of much power, and, consequently, are seldom prescribed.

SECTION XIII.

SIALAGOGUES.—MEDICAMENTA SIALAGOGA.

Syn.—Salivantia. Apophlegmatismata.

THE term Sialagogue is derived from the Greek words σιαλος, saliva, and the verb αγω, I lead forth. Sialagogues are "medicines that increase, to a considerable degree, the excretion of the saliva, and cause it to be discharged in a thinner state than usual." Besides increasing the discharge of the sa-

livary glands, they also greatly augment the excretion from the mucous follicles of the mouth and fauces; operating as local stimulants when topically applied to the excretory ducts of the salivary glands and to those of the mucous follicles.

The mucous membrane of the mouth communicates with that of the nose and the Eustachian tube, extending to the inner surface of the membrana tympani: it sends also prolongations into the excretory ducts of the salivary glands. In the mouth, it produces, independent of the secretions of the salivary glands, two distinct fluids:—one albuminous and aqueous, which exhales; the other a mucous fluid, which is secreted in numerous follicles, seated in the substance of the membrane. These follicles, although they have the character of glands, yet are merely sac-like depressions of the mucous membrane, and pour out unceasingly, through imperceptible orifices, the mucus which lubricates the mouth and supplies to its surface the place of the epidermis on the skin, operating as a defence against the too powerful action of substances taken into the mouth on the nervous fibrillæ. These glands, when cut into, appear vascular, and are penetrated by nervous fibrils, twigs of the ganglionic portion of the third division of the fifth pair of nerves, which furnish sensibility to the mouth, independent of the function of taste. There are three orders of salivary glands. 1. The *parotids*, which occupy the hollow between the mastoid process of the temporal bone and the angle of the lower jaw, betwixt the ear and the jaw, immediately over the massiter muscle, stretching up towards the zygomatic process. The surface of these glands is unequal, from their being composed of lobules, united by a cellular membrane. Each lobule is supplied with an excretory duct, which passes into a common trunk, that begins near the upper part of the gland and pierces the buccinator muscle, opening upon the lining membrane of the cheek, opposite to the second or third molar tooth. It is supplied with blood vessels and nerves; and when the exciting substances are taken into the mouth, the stimulus, being communicated from its orifice to each glandular lobule, an increased secretion of saliva is the result; and this is poured through the secondary ducts into the trunk or, as it is termed, *duct of steno*, and thence into the mouth. 2. The *submaxillary*, which are of an irregular oval form, lie under the lower jaw, over the tendon of the digastric muscle, and generally involve the facial artery as it passes over the lower jaw. The cells are extremely minute, and are united into small grape-like bundles, from four to seven times larger than the cells themselves: the ducts of these glands form common ducts, which have been named Whartonian, and open on each side of the frænum, or bridle of the tongue, near the gums of the incisor teeth. When these ducts are excited by any sti-

mulating or acrid substance taken into the mouth, they become erected, and their open mouths are seen distinctly: in this state they pour out freely the saliva secreted in the glands.

The glands of the third order, from their position under the tongue, are termed *sublingual*, and are separated from the mouth only by its lining membrane. They open by the small lateral Rivinian ducts upon the lower surface of the tongue.

From these glands the saliva is poured out, to the amount, according to the statement of Dr. C. G. Mitscherlich, who had an opportunity of ascertaining it in a man who had a fistula of the Stenonian gland, of about a pound and four ounces in twenty-four hours*. The quantity is greatly augmented by stimulants, whether corporeal or mental. The saliva in its natural state is a watery, somewhat viscid fluid, insipid, inodorous, alkaline in children, and acid in adults; it contains about 1 per cent. of solid matter, and consists of the following constituents:

Berzelius.		Mitscherlich.	
Water	992·9	Chloride of Potassium	0·18
A peculiar Animal Matter	2·9	Potassa with Lactic Acid	0·094
Mucus or Albumen	1·4	Soda with Ditto	0·024
Alkaline Muriates	1·7	Lactic Acid	0·164
Lactate of Soda	0·9	Phosphate of Lime	0·017
Pure Soda	0·2	Silicic Earth	0·015
	1000·0		

When mixed with distilled water, a flaky matter subsides. Besides the salts noticed by Berzelius, chloride of iron detects the sulpho-cyanate of potassa; chloride of barium, a sulphate; and diacetate of lead, a carbonate. According to Tiediman and Gmelin, the solid matter in saliva is $\frac{1}{17}$th per cent.; the soluble salts in it are acetate, phosphate, sulphate, hydrochlorate, and sulpho-cyanate of potassa; the insoluble salts, the phosphate and carbonate of lime, and a minute portion of magnesia. Some physiologists imagine that the three glands afford each a different kind of saliva; and that, as the sublingual greatly resemble the mucous glands, the fluid furnished by them is a modification of the common mucus of the mouth. During mastication, the excretion of saliva is certainly greater than might, a priori, be expected. In a case of wounded œsophagus, Dr. Gairdner asserts that from six to eight ounces were discharged during a meal. Besides the saliva, the mucus of the labial and bucal glands, and that also of those of the tongue, is poured into the mouth and mixes with the saliva; and it is the combined action of these on the food during mastication which prepares it to be acted on in the stomach by the gastric juice. Hence the necessity for a due supply of this fluid; and the care which Nature has taken to secure it by not entrusting it to one organ.

* Mitzcherlich, ubrer den Speichel des Menschen. Rust's Mag. 1832.

Now, such being the nature of these glands, and the orifices of their excretory ducts being irritable, the mode of action of Sialagogues is readily understood. They are taken into the mouth and masticated; by which means their acrid and other stimulating components are separated and dissolved in the saliva and mucus: in this state they stimulate the orifices of the salivary ducts; the excitement is extended to the glands and *their* vessels, in a manner analogous to the action of Errhines on the pituitary membrane, and the same result follows. The impetus of the blood vessels passing into the glands being augmented, a greater quantity of blood is carried through them in a given time; the quantity of the natural secretion is thus greater in the proportion to the supply of blood; and the excretories being full, and at the same time stimulated to exert their proper function, a greater quantity of saliva is poured into the mouth. The *thinness* of the fluid which is excreted from the glands, under the influence of Sialagogues, is, in part, owing to the hasty and imperfect manner in which it is secreted; partly, when the quantity is great, from its not being long enough retained in the mouth to permit the absorption of the aqueous part, and consequently its natural inspissation does not take place. It must, however, be also recollected that all *direct* Sialagogues are masticated, and that this process produces an increased flow of the saliva; the preternatural flow, therefore, is owing partly to mastication, partly to the stimulating qualities of the substance employed as a Sialagogue. The influence, however, of the movement of the jaws is combated by Borden and others; who deny that the parotids are compressed in this movement, and maintain that such compression would rather impede than promote the secretion and excretion of the saliva. Indeed, if we consider the effect of speaking on the secretion and excretion of this fluid, we shall then be satisfied that little results from the mechanical pressure which is supposed to attend the movement of the jaws. That stimulants are necessary to produce the flow of the salivary glands, experience has taught to Asiatic nations, who employ masticatories daily, consisting of a mixture of the Piper *betel*, tobacco, quicklime, and the leaves of the Areca *catechu*.

Sialagogues, by the superabundant discharge of the natural secretion which they cause, exert some influence on the whole of the carotid system of vessels, and thence on those generally of the habit, and diminish the quantity of the circulating fluid in a degree equal at least to that of some other evacuants. This is rendered evident by the emaciation which follows the continued use of Sialagogues. It is therefore obvious that, although their immediate operation extends only within a limited sphere, yet that their influence is general.

As all Sialagogues are acrid substances, and influence the

nervous energy, they cause pungent sensations on the organ of taste; and it is not improbable that some part of their influence depends on this impression. It is indeed only upon this principle of action that we can explain their efficacy in paralysis of the tongue and other organs of deglutition; for although the motor nerves are those chiefly affected, yet those of sensation are always, also, in fault in cases in which stimulant masticatories are likely to prove serviceable. I have already had occasion to remark the force of habit, in changing sensations which are at first highly disagreeable, and even painful, into those which are pleasurable. Thus, the use of tobacco, as a masticatory, is at first nauseating and painful; but, by continued use, it becomes so agreeable as to be prized as a luxury, and in many instances is regarded almost as a necessary of life. Like opium, it seems to invigorate the frame and to rouse the corporeal strength to extraordinary exertion. To those unaccustomed to its stimulus, the privation of it is an evil which they cannot appreciate. An anecdote which an old man, a collector of furs in North America, detailed to me, is highly illustrative of this fact. He had lost his way in the woods, and had not tasted food for two days, when he met with a party of Indians, who, like himself, had been unsuccessful in the chase. As they had no food, he requested, as the next greatest favour that could be granted to him, a small quantity of tobacco; but there was only one quid remaining in the party, and that was already half masticated. A man, however, suffering under hunger and fatigue, is not nice: he begged it so earnestly, that the Indian took it from his mouth, and, dividing it, gave him one half; he received the gift thankfully; it recruited his exhausted powers, and, to use his own language, "preserved his life by supporting him until he reached his quarters and obtained some substantial nourishment."

Sialagogues, properly employed, produce salutary effects, which are extended to the œsophagus, the bronchial tubes, and even to the stomach. They are administered successfully in rheumatism of the throat and the jaws; in toothache; in chronic cephalalgia; lethargy; a tendency to apoplexy, and similar affections. They are also used in paralytic affections of the tongue: and to restore and maintain the cohesive power of the fibrous tissue of the gums, in a spongy state of these parts. As far as paralysis is concerned, it is only in the local state of the disease that they can prove beneficial; and certainly this is a form of paralysis which is comparatively rare.

TABLE OF SIALAGOGUES.

a. Volatile Oil—contained in				
	Cochlearia *Armoracia.*	15.	1.	Cruciferæ
	Acorus *Calamus.*	6.	1.	Acoraceæ.
b. Fixed Acrid Oil and Resin—contained in				
	Anthemis *Pyrethrum.*	20.	2.	Asteraceæ.
	Zinziber *officinalis.*	1.	1.	Gingiberaceæ.
	Daphne *Mezereum.*	8.	1.	Thymelaceæ.
	Nicotiana *Tabacum.*	5.	1.	Solanaceæ.

SUBSTANCES WHICH OPERATE AS SIALAGOGUES.

a. Volatile Oil. *Oleum Volatile.*—The nature and chemical properties of Volatile Oil have been already sufficiently explained (p. 26). In its natural combination in plants, it is employed as a Sialagogue: but why it is not used for that purpose in its uncombined state I am not aware; as it is well known that Volatile Oils, applied on cotton in toothache, augment greatly the flow of the saliva.

1. Horse Raddish. *Armoraciæ.* L. E. *Cochleariæ Armoraciæ Radix.* D.—This species of Cochlearia, which is a native of Brittany and other parts of France, is extensively cultivated in this country. It flowers in May, but does not ripen its seeds. It belongs to the natural order Cruciferæ*. The plant is an annual, but the root is perennial and viviparous. The root is long, fusiform, fleshy, and succulent, and exhales a very pungent odour. The taste is acrid and sweet. The stem rises about two feet high, and bears a corymbe of white flowers. The radical leaves are large, oblong, crenated, wavy; the upper ones pinnatifed. The root is employed as a Sialagogue in the recent state, as it loses much of its acrimony by keeping. It has been used in paralysis of the tongue; but is seldom ordered as a Sialagogue.

2. Sweet Flag. *Acorus.* L. *Calamus Arunaticus.* E.—This Rhizome, as has been already stated (p. 40), owes its properties also to a volatile oil, which is readily procured in a separate state; and, if combined with starch in the form of a lozenge, might be advantageously employed as a Sialagogue. The Rhizome, however, is preferred; but it is rarely used.

FIXED ACRID OIL.

In denoting fixed oil as an acrid substance, adequate to

* Woodville's Med. Bot. third edition, p 400, pl. 145 London Dispensatory, art. Cochlearia. Richard, Hist. Nat. Med. t. ii. p 955. Hayne, v. 29. Lindley, 91.

stimulate the salivary glands and operate as a Sialagogue, it is necessary to mention, that the oil may be merely the vehicle of some acrid matter, which, it is probable, exists as a distinct principle. The combination, however, is so complete, that the latter has never been procured separate from the former; and consequently the appellation *acrid fixed oil* is fully authorized.

1. Pellitory Root. *Pyrethrum.* L. E. D.—The plant which yields this fruit was formerly regarded as an Anthemis; but De Candolle, who has examined it with attention, has removed it into a new genus, and named it Anacyclus *Pyrethrum.* It belongs to the natural order Asteraceæ*. It is a native of the coast of Barbary, of Arabia, and Syria. The root, which is the part employed, is imported from the Levant, in pieces of from three to four inches long, covered with a pale brown cuticle, studded with small black shining spots, breaking with a resinous fracture†. Its properties depend on an acrid fixed oil and gum, which M. Gauthier discovered in it, in combination with volatile oil, gum, inulin, and chloride of calcium‡. It has also been analysed by Parisel, Koene, Hagin, and Schönwald; the two latter of whom found in it a scentless volatile oil, to which Dr. Christison thinks probably belongs its active properties§. It impresses a peculiar pricking sensation on the tongue, which is not very perceptible at first, owing to the little solubility of its acrid principle; but this sensation soon increases, and excites salivation. The root has been long employed as a Sialagogue, and is more relied upon than any other in paralysis of the tongue and the organs of deglutition; and in relaxation of the uvula.

2. Ginger. *Zingiber.* L. E. *Amanum Zingiber Radix.* D. The Rhizome of Ginger has been already described (p. 48): the Acrid Resin which it contains is involved in a large quantity of fecula: it acts powerfully on the nerves of the mucous membrane; and therefore possesses Sialagogue powers. It may be advantageously employed in paralysis of the tongue and muscles of the gullet; but, for the reasons which were formerly stated, the saliva ought not to be swallowed by those afflicted with stricture of the urethra.

3. Tobacco. *Tabacum.* L. E. *Nicotianæ Tabacum.* D. —From what was formerly said respecting Tobacço and its chemical constituents, it is scarcely necessary to state, in noticing it as a Sialagogue, that although its primary action be stimulant, and it is thereby calculated to increase the flow of the saliva, yet, as it exerts also a narcotic influence, it

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* Lindley, 460.

† Dr. Pereira informs us that none has been imported since 1836. Elements of Mat. Med. vol. ii. 1349.

‡ Journal de Pharmacie, 1818, p. 33.

§ Dispensatory, p. 760.

requires to be employed with caution; and particular care should be taken not to swallow the saliva. This is a circumstance less likely to occur when the tobacco is chewed by one unaccustomed to its use, as the nauseous taste tends greatly to prevent the saliva from being swallowed; its narcotic influence, therefore, on the heart and arterial system is only partially felt. When Tobacco is chewed to relieve toothache, the acrid oil which it contains stimulates powerfully the salivary glands and their excretory ducts; and something is due to this effect; but the relief from pain is doubtless owing to the sedative influence of the Tobacco; and, on this account, we find that this is more rapidly procured from smoking than from chewing. The first effect in both cases, on those unaccustomed to the use of the plant, is transient excitement, with an accelerated pulse; this is followed by collapse, giddiness, fainting, and sickness, and accompanied with a weak, quivering pulse, and, not uncommonly, some degree of somnolency. The Tobacco should be in that state in which it is prepared for the purposes of chewing, which is done by merely freeing the leaf from its mid-rib, moistening and rolling it up, by the aid of a machine, or, as it is termed, spinning. It is contraindicated in cases of paralysis of the organs of deglutition.

2. MEZEREON. *Mezereum.* L. *Mezereon.* E. *Cortex Daphnes Mezerei.* D.—The Mezereon, or Spurge Olive, is an indigenous plant, belonging to the natural order Thymelaceæ*. It rises about three to four feet, with an upright stem, and smooth, pliant, leafy branches: the leaves are alternate, scattered, stalked, lanceolate, smooth, and about two inches long, appearing after the flowers, which are seated in little tufts on the naked twigs, interspersed with ovate, brown bracts. The flower is tubular, consisting of a calyx only, four times divided at the limb, and pink. The fruit is a scarlet berry. The bark of the root of this plant contains an acrid resin, and owes its acrimony partly to that and a peculiar principle that may be separated from the resin. Vauquelin, who discovered this principle in D. *Alpina*, in 1808, named it *Daphnin*†. It is procured by digesting the bark in alcohol, evaporating the tincture to the consistence of syrup, and then mixing the residue with water. The resin is precipitated and the Daphnin dissolved in the water: the solution, after the filtration, is to be precipitated by acetate of lead; and the precipitate being suspended in water, and freed from any excess of acetate of lead by means of sulphuretted hydrogen gas, what remains in solution is the Daphnina. On evaporation, it crystallizes in small, prismatic, colourless, bril-

* Woodville's Med. Bot. 3rd edit. p. 717. London Dispensatory, art. Daphne. Richard, Hist. Nat. Med. t. i, p. 493. Hayne, iii, 43. Lindley, 324.
† Ann. de Chem. tome lxxxvi, p. 174.

liant, transparent crystals, very soluble in hot water, from which, however, they are deposited on cooling; very soluble in alcohol, and acquiring a yellow colour on the addition of a little solution of potassa or its carbonate, or of baryta, or lime. Their solution is not precipitated by acetate of lead. It impresses a permanent acrimony on the organ of tasting.

If direct Sialagogues are to be confided in, the bark of the root of Mezereon is a local stimulant of this description of great power. In its dried state, it has a smooth, olive-coloured epidermis, covering a thin, green, cellular web, and a yellowish-white, tough, fibrous liber: when chewed, it tastes at first slightly sweetish, and then becomes hot and corrosive to the mouth. It contains, according to Gmelin, wax, resin, Daphnin, a red colouring matter, an uncrystallizable sugar, a brown colouring matter, malates, gum, and lignine*." In a case of difficulty of swallowing, from paralysis of three years' standing, Dr. Withering prescribed Mezereon root as a masticatory. In less than a month his patient recovered the powers of deglutition. A small portion of the bark should be kept constantly in the mouth; and the saliva should be as assiduously rejected as when tobacco is employed. Its injurious influence when taken into the stomach is well illustrated by the following fact. When the French army was in Corsica, the soldiers often dried their meat by smoking it with wood fires: some of them having used the Mezereon for this purpose, they were attacked with erosions of the mouth, stomach, and intestines, and died in great torture†.

Such are the few substances usually employed as direct Sialagogues—an order of remedies now rarely prescribed, but which, nevertheless, like Errhines, requires to be known. There is one affection not much understood, and not described in the writings of medical authors, in which I am of opinion they may prove useful. I refer to a peculiar *dry* state of the fauces and soft palate, which is not an unfrequent sequel of inflammation of the mucous membrane of these parts. It appears to depend on a chronic subacute inflammation, which, from its habitual influence, interrupts the natural action of the mucous glands, and is to be relieved by inducing in the vessels of the part a new action, sufficient to overcome the diseased action.

* Gmelin, Handb. d. Chem. Bot. ii. § 1317.
† Sage, sur le Moyen de Remèdes aux Poisons Végétaux—Paris, 1811.

SECTION XIV.

EXPECTORANTS.—MEDICAMENTA EXPECTORANTIA.

Syn.—Pectorales.

It is not easy to frame a satisfactory and comprehensive definition of this order of medicines: they are said to be "medicines which promote the excretion of mucus and fluids from the lungs and trachea." Were the correctness of this definition fully determined, considering the great importance of the lungs to the well-being of the animal œconomy, there is no class of medicines that would so much merit our attention. But any theory which can be given, not only of the mode in which Expectorants operate, but of their existence *at all* as promoters of the excretion of the mucus from the lungs, *is doubtful;* we must, therefore, receive *every thing* that can be said regarding them with some degree of distrust.

The mucous membrane lining the trachea and bronchial tubes is *supposed* to be the *only* part upon which Expectorants act; but in whatever manner the mucus, *either morbidly secreted or augmented in quantity,* is removed, it is essential to know the manner in which either its acrimony or its over abundance *can prove injurious* to the functions of life, before we can fully understand the necessity for removing it, or form any opinion of the manner in which it is excreted.

The whole system of pulmonary tubes in man is lined by a vascular and highly sensible membrane, an extension of the lining membrane of the fauces, denominated the mucous membrane, from the nature of the secretion with which it is constantly moistened. Each lung is a tissue of air cells, in which the minute bronchial tubes terminate, and into which a small artery with its accompanying veins enter, and form around it a close net-work of vessels*. These air cells, it has been ascertained, are smaller in infants than in adults; in middle-aged adults smaller than in older persons: the average in a middle-aged man may be estimated to be about $\frac{1}{90}$ of an inch in diameter. These cells have no connection with one another, nor with the surrounding cellular tissue of the lungs. The form of the cell is nearly a hollow sphere. Besides the mucous membrane which lines the air tubes and the bronchial cells, each distinct cell is supplied, exteriorly to the mucous tissue, with *white, elastic* fibres; and over these a muscular coat, consisting of transverse fibres, only visible to the eye aided by the micros-

* Reisseisen de fabrica pulmonum, Berol. 1822.

cope. These cells are supplied, also, with another set of arteries, intended for the nourishment of the lungs, proceeding from the descending aorta, and named the bronchial arteries; whilst the former is designed to expose the blood to the action of the air in the cells, and form the ultimate branches of the pulmonary artery, the trunk of which commences in the right ventricle. To effect this change from the state of venous into arterial blood, the air must be received into the lungs, and pass into the bronchial cells, whence it is as rapidly expelled as it was received: and this alternate reception and expulsion of the air *into* and *from* the lungs constitute inspiration and expiration, or, conjointly, respiration.

When the air is admitted into the lungs, the thorax is enlarged *laterally* and *inferiorly*, the ribs are elevated, the diaphragm descends, and the recti muscles of the abdomen, with the oblique and the transverse muscles, are forcibly extended by the pressure downwards of the abdominal viscera. During this process the air rushes into the lungs, owing to the greater gravity of the external air than that contained in the lungs, in addition to the diminished resistance afforded by the enlargement of the cavity of the thorax, and distends the whole system of bronchial cells. Such is the mechanism of inspiration. Now, what follows?—In a few seconds the mastoideus, the trapezeus, the serratus, the diaphragm, and intercostal muscles, cease to act, and the abdominal muscles recover their ordinary state of contraction; whilst, at the same time, the substance of the lungs, contracting by its natural elasticity, resumes its former dimensions, and expels the additional volume of air which had just been admitted. But, in *addition* to these changes of condition in the respiratory muscles and in the lungs, generally speaking, the *muscular* and *elastic* fibres which surround the bronchial cells *now contract* and aid in the more effectual emptying of the lungs. This, however, is *never* complete; as the retention of a certain portion of air is necessary to maintain some degree of distension of the air cells after expiration. Such, however, is the mechanism of natural expiration. When the contraction is so great as almost wholly to expel the last portion of air from the air cells—a circumstance which occurs in the spasmodic cough of hooping-cough—as soon as the spasmodic contraction yields, the external air *rushes* into the lungs with a wheezing noise, resembling that which occurs when the air is admitted into the exhausted receiver of an air pump: but *no such sound* is heard in natural and healthy respiration. It is, therefore, obvious that this elasticity of the lungs is a very important agent in expiration; and, so little are the muscles of the abdomen concerned in this part of the respiratory process, that children who have been born without them, have lived for some time and breathed naturally; yet it would be an error to assert that respiration is not the

operation of the conjoint action of the mastoideus, trapezeus, serratus, and intercostal muscles, the diaphragm, the abdominal muscles, and the muscular contraction of the air cells of the lungs themselves, by which, as I have already stated, the last portions of the air are expelled. Such, then, is the mechanism of the respiratory function. The nerves engaged in effecting respiration arise from a distint column or fasciculus of the spinal marrow, lateral as regards the anterior and posterior columns: and it is from the par vagum, one of the nerves receiving its origin from this fasciculus, that the nerves of the bronchial cells are derived. The excitement of these nerves, therefore, causes the act of respiration; the alternate inspiration and expiration of the atmospherical air.

That breathing is absolutely necessary for the maintenance of animal life, every day's experience proclaims; and it is equally certain that the air expired differs from that inspired, not in the volume of the air only, but in its chemical constituents; and hence the function of respiration includes not only the renewing of the air in the lungs, but the changes which it undergoes there, and also those effected in the blood. Without entering into the examination of this chemical change, it is sufficient for our purpose to know that the air must be admitted into the air cells for the preservation of life; that carbonic acid must be removed from the blood circulating through the lungs, and exposed to the action of the air in the bronchial cells, and that oxygen must be supplied to it through the same channel. Whatever, therefore, obstructs its passage of the air to these cells, is an obstacle which must be removed. When this is accumulated mucus, or when it is inspissated, or viscid and adhering to the sides of the bronchial tubes, or when the secretion is rendered acrid by inflammatory action being excited in the mucous membrane of these tubes, so as to impede in any manner the function of respiration, then Expectorants become useful, inasmuch as they contribute to the removal of these morbid causes of *impeded*, or *interrupted*, or *irregular* respiration. A question naturally arises —how can they effect this removal? Do the substances taken as Expectorants proceed to the lungs, and there act?

Before answering these questions, it is proper to state, that many substances, when introduced into the system through the stomach, escape by the lungs. This is the case with various *gases*, *ether*, *alcohol*, *phosphorus*, and *camphor*, which, soon after they are taken into the stomach, are perceived in the breath; and this is the case with oil of turpentine also, which, if injected in small quantity into the crural vein, as in the experiment of Dr. Breschet and Dr. Edwards, is strongly exhaled from the lungs, although no odour of it is perceived on exposing the peritoneum; and, what is very singular, if a cupping glass be applied over any denuded part, the odour is not perceived in the

lungs. But although we are convinced that the lungs act as emunctories, and afford exit to many things which have entered the circulation, yet, supposing that every medicinal article exhibited with the view of producing expectoration enters the circulation, and is thrown off by the medium of the mucous membrane of the lungs, it would not aid much in explaining the theory of Expectoration. We must, therefore, have recourse to some other method of accounting for the manner by which the lungs are freed from offending matters; that is, by which expectoration is effected.

In the table of Expectorants, those medicines which are supposed to operate as such are arranged into *two* divisions: 1, *those* which effect the excretion of mucus or other fluids from the lungs by *topical* means: 2, those which effect it by *general* means.

I. *Topical Expectorants* may operate in two ways. 1. They may act upon the nerves of the bronchial cells, and, exciting all the respiratory muscles into strong action, and rendering expiration more forcible, may *facilitate* the expulsion of matters from the air tubes of the lungs. 2. They may operate by mechanically compressing the thoracic viscera, so as to induce a sudden and forcible expiratory effort, sufficient to effect the expulsion of matters from the lungs.

1. *a.* Medicines which stimulate the respiratory muscles, effect the excretion of mucus by coughing.

The effect of coughing is a short and forcible expiratory effort frequently repeated; the inspirations in the intervals being trifling in comparison to the expirations. It is, in a great degree, a voluntary effort; and the effect of the air in traversing the trachea and its branches, in the forcible exit of each portion, as thrown out by the sudden contraction of the abdominal and other respiratory muscles, detaches any mucus, or whatever else is contained in the air tubes, and expels it. Any irritation immediately applied to the fauces, the glottis, the larynx, the lungs, and even the Eustachian tube, acting upon branches of that series of nerves which are particularly intended for the function of respiration, excites involuntary coughing; but the action excited may, in a great measure, be moderated, if it cannot be altogether checked and terminated, at the will of the individual. Coughing is, therefore, an effort either of the will or of the system, from the irritation of a certain set of nerves acting on the respiratory muscles to relieve the trachea and bronchial system of some offending cause: it is therefore a salutary phenomenon. In those weakened by disease or other causes, the difficulty of exciting the action of coughing, with force sufficient to produce the effect intended, is so obvious as to strike the ordinary as well as the professional observer. The distress arising from this circumstance, the *uneasiness* excited

by the irritating matter that coughing forcibly would readily remove, and the *sense of suffocation* experienced from an accumulation of mucus in the bronchial tubes obstructing the free passage of the air to the bronchial cells, are very considerable. In such states of the chest, the topical application of a stimulant to the bronchial nerves may so far rouse the exhausted excitability as to enable the muscles to undergo the necessary exertion; whilst, at the same time, the substances employed to excite this, may be of a nature to prove also beneficial, by imparting a renewed healthy action to the diseased mucous membrane. Under this head of the table, therefore, will be found several stimulants well adapted to fulfil this intention.

The whole of the substances arranged under this head stimulate so powerfully as to require the utmost caution in their administration; but, as the atmospherical air is the vehicle by which they are conveyed into the lungs, there is no difficulty in apportioning the degree of dilution to the quantity of stimulus required or admissible.

2. *a.* The second set of topical Expectorants are emetic substances. In the operation of vomiting, by the sudden and violent contraction of the abdominal muscles, in order to force the contents of the stomach upwards, an impulse is communicated to the whole bronchial system; and, by this means, the expiratory effort being rendered more forcible, the expulsion of the mucus lodged in the pulmonary tubes is effected. Whether this explanation be satisfactory, others must determine: the fact of the beneficial result of the action of emetics, in clearing away mucous accumulations from the lungs, is well known; and frequent recourse is had to them in the disease of children, with uniform advantage.

It might be supposed that the best emetics for expectorant purposes would be those which operate by directly stimulating the nerves of the stomach, and which call the muscles necessary in the mechanism of vomiting into immediate action, by sympathy with that organ: but experience has demonstrated that the antimonial preparations are, perhaps, better suited for this purpose than any other; not only because their action is more forcible, and therefore likely to aid in expelling the mucus of the air tubes, by the communication of the mechanical impulse which it produces, but also by the power which they possess of controlling inflammatory action. Expectoration procured by emetics was formerly in much vogue as a remedy in Phthisis *Pulmonalis*. The emetics for this purpose, however, were seldom selected upon any principles: at *one time* we find sulphates of zinc and of copper employed; in *another*, antimonials, chiefly in the form of the antimonial wine, or vinous solution of the Potassio-tartrate of Antimony given to the extent of f℥vi in a solution of the extract of liquorice root. This an-

timonial was supposed to produce vomiting, accompanied with copious expectoration, whilst the force and frequency of the pulse were materially diminished. I have had opportunities of witnessing the effects of this mode of treating tubercular consumption; and certainly it must be acknowledged, that it has done more to relieve many of the most urgent symptoms than any other mode of treatment; yet, like every other remedy in that merciless malady, it has frequently failed to produce the desired effect. Ipecacuanha and all other emetics act in a similar manner to those I have just mentioned, and promote expectoration. If the lungs be loaded with mucus, and little or no febrile action be present, the *direct* emetics are to be preferred; because it is only the mechanical impulse which is then required.

Squill and sulphuret of potassa have also been employed to excite vomiting in aid of their expectorant property.

II. *General Expectorants.*—These operate either by entering the circulation or through sympathy with the stomach: the *first* directly stimulate the pulmonary exhalants; the *second* affect the excretories by the nausea which they induce.

a. There is sufficient evidence that some medicinal substances, when taken into the stomach or applied to the surface, are absorbed, and, entering the circulation, are exhaled by the lungs. No explanation can be given of the reason why these substances, passing through the circulating system, are thrown off by one emunctory rather than by another; but the fact is well ascertained. Now it is probable that these matters, in passing through the exhalant vessels, stimulate them directly to increased action, and thence to the performance, in an augmented degree, of their proper function; so that, by the production of a greater quantity of aqueous matter by the mucous follicles, their contents are poured out in a less viscid state. In admitting this explanation to a certain extent, we must not lose sight of the fact, that the most easily excreted mucus from the trachea and bronchial tubes is not that which is in the most fluid form, but in that peculiar state which, independent altogether of simple consistence, is requisite to enable it to be readily excreted. In asthmatics, a thin or watery excretion is always more distressing and more difficult to expel, requiring a greater effort of coughing than one which is more consistent, and, as the term is, well concocted. The expired air passes partially through the thin fluid, giving it a frothy character; while that of a thicker description, which seldom adheres very firmly to the sides of the tube, is driven before the propelling air, and is thus easily rejected from the trachea.

b. In explaining the operation of these general Expectorants, which affect the pulmonary excretions by the nausea which they induce, we must take into consideration the similarity between the function of the skin and that of the mucous

membrane of the bronchial tubes. Both are exhalant organs; and both, in febrile and inflammatory states of the habit, are liable to constriction, which impedes the exhalant function, and gives origin to a train of morbid phenomena connected with the deficiency of the natural lubricating mucous secretion. In this condition of the mucous membrane, nauseants taken into the stomach, either by the sickness which they induce, or by simply allaying irritation, relax the constricted capillaries and promote expectoration.

TABLE OF EXPECTORANTS.

A.—TOPICAL EXPECTORANTS.

* *Stimulating the Respiratory Muscles.*

a.—Benzoic Acid, procured from Benzoin.			
Styrax *Benzoin.*	20.	1.	Styraceæ.
b.—Acetic Acid.			

* * *Stimulating the Pulmonary Exhalants.*

c.—Tobacco, dried leaves of.			
Nicotiana *Tabacum.*	5.	1.	Solanaceæ.
* ——— *rustica.*	–	–	———
* ——— *Persica.*	–	–	———
d.—Stramonium, herb of.			
Datura *stramonium*	5.	1.	———
* ——— *Tatula*	–	–	———
e.—Vapour of Boiling Tar.			
f.————— Burning Wool.			
g.—Ammonia.			
h.—Carbonate of Ammonia.			

* * * *Mechanically compressing the Thoracic Viscera.*

i.—Emetic Substances.

B.—GENERAL EXPECTORANTS.

Stimulating the Pulmonary Exhalants through the Circulation.

Organic Substances.

a.—Emetina, contained in the root of			
Cephaëlis *Ipecacuanha.*	5.	1.	Cinchonaceæ.
b.—Scillitina, in the bulb of			
Scilla *Maritima.*	6.	1.	Liliaceæ.
c.—Gum Resins, proper juices of.			
Ferula *Assafœtida.*	5.	2.	Umbelliferæ.

	Ferula *Persica.*	5. 2.	Umbelliferæ.
*	——— *orientalis.*	– –	———
*	——— *ferulago.*	– –	———
*	——— *tingitana.*	– –	———
	Dorema *Ammoniacum.*	5. 2.	———
	Galbanum *officinale.*	5. 2.	———
	Balsamodendron *Myrrha.*	8. 1.	Burceraceæ.
d.—Balsams.			
	Myrospermum *Peruiferum.*	10. 1.	Amyridaceæ.
	——— *toluiferum.*	10. 1.	———
	Styrax *officinale.*	10. 1.	Styraceæ.
	Styrax *Benzoin.*	20. 1.	———
e.—Oleo-resins.			
	Copaifera *Langsdorfii.*	10. 1.	Amyridaceæ.
*	——— *Jaquini.*	— –	———
*	——— *multijuga.*	— –	———
*	——— *coriacea.*	— –	———
f.—Bitter Extractive.			
	Marrubium *vulgare.*	14. 1.	Labiatæ.
	Tussilago *farfara.*	19. 2.	Asteraceæ.
	Cetraria *Islandica.*	24. 3.	Lichenes.

* * *Inorganic Substances.*

g.—Ammonia.
h.—Carbonate of Ammonia.

* * *Exciting Nausea.*

Organic Products.

a.—Emetina,			
	Cephaëlis *Ipecacuanha.*	5. 1.	Cinchonaceæ.

Inorganic Substances.

b. —Antimonials.
c.—Potassii Sulphuretum.

A. TOPICAL EXPECTORANTS.

Substances which operate as Expectorants by stimulating the Mucous Membrane and rousing into action the Respiratory Muscles.

a. Benzoic Acid. *Acidum Benzoicum.* L. E. D.—According to the London and the Edinburgh Pharmacopœias, this acid is procured by the mere application of heat to Benzoin, put into a proper vessel (a glass mattrass, E.), placed on a sand-bath, and the heat gradually increased as long as any vapours rise. The crude acid thus procured should be pressed between folds of

bibulous paper and resublimed. The Dublin process is operose, and more expensive than the value of the acid admits of. Five parts of Benzoin are ordered to be triturated with one part of fresh burnt lime, and then boiled for half an hour in one hundred and fifty parts of water, with constant stirring, and the fluid decanted when cold. The residue is to be boiled again with fifty parts of water, and the fluid, when cold, decanted. These fluids, mixed together, are next to be evaporated to one half, filtered, and, when cold, mixed with one part of hydrochloric acid. The liquid is to be decanted, and the precipitate, which is crude Benzoic acid, washed with a little cold water, dried with gentle warmth, and, lastly, sublimed in a proper vessel, with a gentle heat. The London and Edinburgh processes afford the largest quantity of the acid; and although it is not perfectly free from the volatile oil of the Benzoin, yet it is sufficiently pure for medicinal purposes.

The Benzoin is supposed to be the production of the Styrax *Benzoin*, a tree growing in Bornea and Sumatra, belonging to the natural order Styraceæ.

Benzoic acid is a white crystallized acid, in oblong, soft prisms, with a glossy lustre: inodorous when pure; but generally having a slight, peculiar odour, owing to the above-mentioned volatile oil; and a sweet, pungent, somewhat bitter, feebly acid taste. Its specific gravity is 0·657. It is fusible, and vaporized by heat without change; is soluble in 200 parts of cold water, and in 24½ parts of boiling water: the solution reddens litmus. Alcohol dissolves it readily, and, when left to evaporate spontaneously, prismatic crystals of the acid are formed: boiling alcohol takes up its own weight of the acid. It is, according to Liebeg, an oxide of a peculiar compound, named Benzoil; ($C.^{14}$ $H.^{5}$ $O.^{2}$); hence the composition of the acid is 5 eq. of hydrogen = 5, + 14 carbon = 85, + 5 oxygen = 24, equiv. 114·68. Its affinity to the resins is very obvious.

The fumes of Benzoin contain the acid, and excite coughing; but as it is questionable whether they are admitted into the trachea, unless largely diluted with atmospherical air, it is in this state of dilution only that the acid can be employed as a topical expectorant.

It has been inhaled in conjunction with aqueous vapour; the Benzoin is broken into morsels, which are put into a jar and boiling water poured over them; a little of the acid and much of the volatile oil are elevated with the aqueous vapour, and thus taken into the lungs. Inhaled through the medium of the air in spasmodic asthma, I have seen it shorten the paroxysm and promote expectoration. We can account for its beneficial influence in asthma more readily than in other pulmonary affections. The difficulty of breathing, and the frothy mucus accumulated in asthma, depending on some morbid, condition approaching to

paralysis of the nerves of the par vagum; hence, any stimulant likely to rouse these to renewed action will probably relieve the disease. According to Sir B. Brodie's experiments, when the par vagum is divided in a dog, the respiration is diminished in frequency, less carbonic acid is evolved, the blood assumes a darker hue than usual, and much frothy mucus is found in the cells after the death of the dog. These are the symptoms of chronic asthma; and it is in this form of asthma that diminished energy of these nerves may exist.

Benzoic acid is occasionally administered internally, for the view of rousing the muscular energy and promoting expectoration in weakened habits; but it is inferior to Carbonate of Ammonia for this purpose.

b. Acetic Acid. *Acidum Aceticum.* L. E. D. (p. 368.)—This volatile acid operates as an expectorant by stimulating the bronchial cells, when it is introduced into the lungs, in conjunction with the vapour of hot water, by means of the inhaler. It is the oldest of those topical remedies which are supposed to excite the action of the respiratory muscles, in clearing the pulmonary tubes of offending mucus. It is more manageable in its application than benzoic acid, and it can be more directly applied; and quickly communicates the desired stimulus to the bronchial nerves. Distilled vinegar should be employed, instead of the common vinegar which contains sulphuric acid. It is advantageously employed in laryngeal inflammation, catarrh, and in asthma, dyspnœa, and other spasmodic affections of the chest.

* * *Substances operating as Expectorants, by stimulating the Pulmonary Exhalants.*

The substances in this section of Expectorants, instead of exciting the respiratory muscles, operate solely on the pulmonary exhalants; and, besides stimulating these vessels, operate also by their general sedative influence in relieving the constriction on them, and thereby facilitate expectoration. In those unaccustomed to their use, they undoubtedly excite coughing; but in this case the spasmodic action is produced by their first impression on the glottis: for when they arrive at the bronchial cells, no coughing is induced.

a. Tobacco. *Tabacum.* L. E. *Nicotianæ Tabaci folia.* D. (p. 308).—Smoking Tobacco has long been known to the unprofessional as the means of allaying violent paroxysms of asthma; but many years have not elapsed since it was prescribed for this purpose by the physician. Let us examine the manner in which Tobacco operates in stimulating the pulmonary exhalants, when received into the lungs in the form of smoke. It must be recollected that both *Nicotina* and the *volatile oil* of Tobacco act powerfully on the animal œconomy; but as Nicotina is more volatile than the volatile oil, and smoking is a species of distillation, it comes over with the smoke, and it is probably

this principle that operates in smoking Tobacco. Its first action is as a topical excitant on the exhalants of the mucous membrane of the pulmonary tubes; but it afterwards acts on the circulating system through the medium of the nerves. This is rendered more evident by the effect of the infusion, which contains the Nicotina, when these are administered in that state of the chest in which there exists something like œdema of the organ, and in which the expectoration is difficult or wholly impeded. In such a state, the infusion aids powerfully expectoration. Nicotina in large doses paralyzes the heart, rendering it insensible to the stimulus of the blood, and the circulation ceases: on this account, we find that fatal effects have arisen from excessive smoking*; and to the same cause we attribute the vertigo, sickness, and fainting, that invariably the first essay in that luxury produces.

Much of the influence of smoking, as an expectorant, depends on the kind of Tobacco employed. The coarse, acrid Tobacco used by the lower classes of the people, and which is the produce of Virginia, contains the largest proportion of Nicotina, and causes the most powerful expectorant effects; but, at the same time, to those unaccustomed to smoking, the most unpleasant results may occur. The Turkish Tobacco is milder and weaker than the Virginian, and has a sweet or honey-like flavour; that of Cumana is the most aromatic†: but the Tobacco most prized for smoking is that which is reared in Cuba and on the Rio Nigro.

Upon the whole, the salutary influence of smoking Tobacco in promoting expectoration cannot be denied, whilst at the same time its narcotic power, when it is employed in excess, weakens the digestive function, obtunds the nervous sensibility, and depresses the whole vital energy.

2. STRAMONIUM. *Stramonii Folia et Semina*. L. D. *Stramonium*. E.—The nature of this plant and its active principle, *Daturia*, have been already described (p. 440). The custom of smoking the dried herb was introduced from Ceylon. It seems to operate in two ways: in the first place, it is applied to the mucous membrane in a state of great irritability, and, as a

* Philosophical Transactions, 1811.

† It is pleasing to trace the origin of popular customs: that of smoking is unknown; but all the Scythian nations employed certain herbs, which they threw into the fire, and the ascending smoke of which the company seated round the fire collected, causing them to dance and sing*. They had also a religious order who smoked herbs through wooden and earthen tubes†; and this mode of using Tobacco prevailed in America when Columbus discovered that continent. "The calumet, or pipe of peace," says Harris, "is a large Tobacco pipe, with a bulb of polished marble and a stem two feet and a half long, made of a strong reed, adorned with feathers and locks of women's hair. When it is used in treaties and embassies, the Indians fill the calumet with the best Tobacco, and, presenting it to them with whom they have concluded any great affair, smoke out of it after them."—Harris's Voy. fol. 1705, v. ii, p. 908.

* Herodotus, lib. i, § 36. † Strab. lib. vii, p. 196.

sedative, allays this condition; thus favouring a slower and more perfect secretion of the mucous follicles; so that the mucus, being in a more natural state, is easily separated and excreted: in the second place, by influencing generally the nervous system, the spasmodic symptoms attendant on the paroxysm of asthma are allayed, and respiration proceeds in a calm and undisturbed manner. I am fully aware that the power of Stramonium has been much overrated; but experience has sufficiently demonstrated its influence as a palliative when smoked in asthma, although it may effect little in establishing the permanent relief of the disease. The use of Stramonium has been objected to by Dr. Bree, a high authority on this subject, from an idea that it gives a tendency to apoplexy; but my experience has afforded me no reason for according with such an opinion.

3. Vapour of boiling Tar.—Sir Alexander Crichton introduced the inhalation of the vapour of boiling Tar as a remedy in catarrh and phthisis. If we examine the components of Tar which are most likely to be raised in the process of boiling, there can be no doubt that the empyreumatic oil and the acetic acid, dissolved in the aqueous vapour, are the principles which stimulate the bronchial tubes when fumes of Tar are breathed. It causes some increase of cough on the first application of it; but by degrees this abates, and the nature of the expectorated matter is said to be much improved. Like many other new remedies, it was overpraised; and therefore has fallen into neglect, the natural consequence of exaggerated encomiums. Dr. Chapman, an American professor of Materia Medica, brings forward, as evidence in favour of this method of employing Tar in phthisis, the circumstance that "a residence in the cedar and pine swamps of North America, during the summer months, is well known sometimes to have been productive of advantage in pulmonary cases." But Dr. Chapman seems to have forgotten the established fact, that swampy situations and damp places, favourable for the production of agues, are favourable also, in a striking degree, to the improvement of pulmonary cases. In our expedition to Walcheren, so destructive to our soldiers, by the intermittents and remittents under which they suffered, many of them who were afflicted with incipient Phthisis lost their coughs, and the complaint was relieved, if not cured.

Another fumigation, which operates in some degree in the same manner as the vapour of Tar, namely, the fumes arising from the vapour of *burning wool* which has not been dressed, was tried by myself in some cases of phthisis, two years ago. In one of them a vomica had burst fortunately into the trachea, and the contents were coughed up. The daily excretion of pus amounted nearly to a fluid pint, and greatly debilitated the patient. The smoke of the burning wool excited great cough-

ing when it was first inhaled; but this rapidly subsided; and although I cannot aver that any benefit arose from the inhalation of this smoke, yet, until a week before the death of this young gentleman, I never witnessed, in this disease, so little disturbance in the system as he suffered. The employment of this vapour was first recommended by Dr. Physick, a popular American physician, who found it useful in stimulating and healing external sores, and hence naturally inferred that it might be equally beneficial if received into the lungs. He conceived that he had established its utility in phthisis; but it has not yet accomplished one cure.

d. AMMONIA. *Ammoniæ Liquor.* L. *Ammoniæ Aqua.* E. D. CARBONATE OF AMMONIA. *Ammoniæ Sesquicarbonas.* L. *Ammoniæ Carbonas.* E. D.—These substances (p. 188, 189) operate in the same manner as the three former articles, as violent irritants on the mouth, windpipe, and, indeed, on the substance of the lungs. But Ammonia, largely diluted, is indicated in cases of humoral asthma and pneumonia, in which the lungs are choked up with frothy mucus that cannot be expectorated. I have seen the internal administration of Ammonia highly beneficial in such cases; but my experience does not permit me to offer an opinion on its utility when inhaled in a gaseous state. Cases are related by Nysten and Orfila of fatal effects have followed its imprudent inhalation by the nostrils. In one of M. Nysten's cases, the patient, a medical man, died on the third day, after having suffered from symptoms resembling those of severe bronchitis, with difficult breathing, copious expectoration, and a serous discharge from the nostrils; in a case detailed in the 14th vol. of the Edinburgh Medical Journal, death occurred in forty-eight hours. These cases render much caution requisite in using Ammonia as a topical expectorant.

* * * *Substances operating as Expectorants, by mechanically compressing the Thoracic Viscera.*

EMETICS.—In the operation of Emetics, by the sudden and violent contraction of the abdominal muscles, in order to force the contents of the stomach upwards, an impulse is communicated to the whole bronchial system, and, by this means, the expiratory effort being more forcible, the expulsion of the mucus in the pulmonary tubes is effected. The beneficial influence of Emetics in clearing away mucous accumulations from the lungs is indeed well known; and they are advantageously prescribed for this purpose in some of the pulmonary diseases of children. It might be supposed that the Emetics most likely to promote expectoration would be those which operate directly on the stomach: but in many cases the antimonial preparations are better suited for expectorant purposes than any other, because they aid both the expulsion of mucus from the bronchial tubes,

and possess the power of controling inflammatory action. The employment of Emetics as expectorants was formerly in much vogue in phthisis; but the selection of Emetics for this purpose was seldom regulated by any fixed principles.

If the lungs be loaded with mucus, and little or no fever is present, the direct Emetics, namely, the sulphates of zinc and of copper, may be employed, as the mechanical impulse only is required; but if, in promoting expectoration, it is advisable to do so by maintaining nausea after vomiting, then ipecacuanha, squill, and the antimonial emetics are to be preferred. In general, however, nauseating Expectorants are prescribed rather to influence the pulmonary exhalants through the circulation, than to evacuate the bronchial tubes by the mechanical impulse communicated to them by the effort of vomiting.

B.—GENERAL EXPECTORANTS.

* *Substances stimulating the pulmonary Exhalants through the Circulation.*

a. EMETINA, or EMETA, and IPECACUANHA (p. 737-739).— I have had no experience of the expectorant influence of Emetina in its uncombined state; but, knowing the effect of small doses of Ipecacuanha, when no nausea is excited, I can credit the French physiologists, who affirm that it exerts a peculiar influence on the pulmonary exhalants. Pure emetina is rarely administered; but on the Continent it is frequently used in its impure state. Its influence on the pulmonary tissue is demonstrated by the post-mortem examination of dogs poisoned by large doses of it, whether administered by the mouth or by the anus, or injected into the jugular vein: in every instance the mucous membrane of the lungs is found inflamed. In old chronic catarrhs, the French physicians have successfully administered it, in doses of the eighth of a grain three or four times a day; and, in more recent catarrh, they have found it equally beneficial in doses of a quarter to half a grain. In these cases it appears to operate, without exciting nausea, by simply promoting expectoration. Now, if we admit that it is determined to the lungs as its emunctory, after entering the circulation, we can understand in what manner it produces its effects, as readily as we can comprehend the reason why old and chronic catarrhs are benefited by the inhalation of chlorine, tar vapour, and other substances that are directly applied to the mucous membrane of the bronchial cells. If we do not admit its direct influence on the pulmonary exhalants, I cannot conceive in what manner it operates, as its beneficial effects are undoubted.

With respect to Ipecacuanha, when it is given in combination with opium, in the form of Dover's powder, in doses of three or four grains, which contain about one third of a grain of

Ipecacuanha and the same quantity of opium, in f℥iss of bitter almond emulsion, it produces the most decided beneficial effects, although neither sweating nor nausea result. The French physicians conceive that Ipecacuanha in substance is less energetic in pulmonary affections, owing to its peculiar fatty principle interfering with the narcotic influence of the Emetina. Setting aside this hypothesis, for it is one, the evidence of the influence of Emetina, as an Expectorant, is one sufficient to recommend it to the notice of British practitioners. At all events, I have no hesitation in ascribing the influence of Ipecacuanha, in small doses, to its introduction into the circulation and its stimulant influence on the pulmonary exhalants.

Ipecacuanha may be administered, for expectorant purposes, in the form of powder, the medium dose of which is gr. ss to gr. ii ; or in that of wine, in doses of m. xx to m. xl, in any bland vehicle containing neither tannic acid nor any other astringent matter.

b. Scillitina (p. 746).—This substance is the active principle of Squill, and was regarded by Vogel, its discoverer, as a simple substance*; but M. Tilloy, of Dijon, asserts that it is a compound of an uncrystallizable sugar, gum, and a bitter acrid principle†. It has not yet been employed as a curative agent in its separate state.

The Squill, *Scilla*, L. E. D., as already stated (p. 745), is the bulb of a liliaceous plant found on the shores of the Mediterranean, and also on those of Normandy, Britany, Portugal, and elsewhere. The bulb is sliced transversely, and dried at a low temperature ; but as it attracts moisture from the air, it should be preserved in well-stopped bottles. It contains about 0·70 parts soluble in water, and 0·30 of woody fibre.

If Scillitina be the active principle of Squill, it is probable that the powder of the dried bulb undergoes decomposition in transitu, and that the Scillitina operates as a stimulant to the mucous membrane of the bronchial tubes: but much obscurity still involves the operation of Squill. According to Vogel's analysis of Squill, it contains 24 per cent. of tannic acid, which, in conjunction with the bitter of the Scillitina itself, will aid the digestion of the mucilaginous constituent of the Squill; and in this manner the Scillitina may be carried into the circulation. The ready solution of Scillitina in alcohol, wine, and vinegar, accounts for the fact, that these vehicles are the best for the administration of Squill as an Expectorant.

As Squill is an excitant Expectorant, it is scarcely necessary to say that its use is contraindicated in all inflammatory cases. It is usually combined with honey and vinegar, or with soap

* Bulletin de Pharm. t. iv. † Journ. de Parm. t. xii, p. 635.

and ammoniacum, as in the following preparations of the Pharmacopœias.

Vinegar of Squill, *Acetum Scillæ*, L. E. D. is made by macerating ℥xv (℥viii, D.) of fresh dried Squill in Ovi (Oiii *old wine measure*, D.) with a gentle heat, in a covered vessel, for twenty-four hours (seven days, D.), afterwards pressing out the liquor, permitting the dregs to subside, and to the clear fluid adding Oss (℥iv, D.) of Proof Spirit (rectified, D.).

The dose, as an Expectorant, is f℈ss to f℈iss.

Oxymel of Squill, *Oxymel Scillæ*, L. D. is a compound of lb. iii of Honey and Oiss of Vinegar of Squill, boiled together, in a glass vessel, with a slow fire, to a proper consistence.

The dose, as an Expectorant, is f℈i to f℈ii.

Syrup of Squill, *Syrupus Scillæ*, E. is prepared by dissolving, with the aid of a gentle heat and agitation, lb. vii of pure Sugar in Oiii of Vinegar of Squill.

The dose, as an Expectorant, is f℈i to f℈ii.

Tincture of Squill. *Tinctura Scillæ*. L. E. D.—Take of fresh dried Squill (in coarse powder, E.) ℥v, Proof Spirit Oii, macerate for fourteen days and strain. The Edinburgh College orders it to be made by percolation, without packing the pulp firmly in the percolater.

The dose, as an Expectorant, is m. x to f℈ss.

Compound Squill Pills, *Pilulæ Scillæ compositæ*, L. D. *Pilulæ Scillæ*, E. are prepared, according to the London and Dublin Colleges, by mixing, in the state of powder, ℈i of fresh dried Squill, ℈ii (℈iii, D.) of Ginger, ℈ii of Ammoniacum; then beating them up with ℈iii of Soap, adding as much Syrup (Molasses, D.) as will form a mass of a proper consistence. The Edinburgh College orders five parts of finely powdered Squill, 4 parts each of Ammoniacum and Ginger, in fine powder, to be beaten, with 4 parts of Spanish Soap and 2 parts of Conserve of Red Roses, into a uniform paste, and divided in five-grain pills.

The dose, as an Expectorant, is from five to twenty grains.

Squill, in any of these forms, is useful in asthma and chronic catarrh. In large doses, it is apt to prove emetic and purgative, or diuretic; so that, as an Expectorant, the doses must be those above mentioned. It should not exceed one grain of the dried bulb. Thirty drops of the tincture is equivalent to this quantity of the dried bulb. When overdosed, it excites the most violent vomiting, purging, and convulsions; symptoms which induced Orfila to refer its operation to the nervous system: the lungs, on dissection, present no appearance of inflammatory action: but inflammation and gangrene of the stomach and intestines take place. The best antidotes are ammonia and other alkalies; on which account, these substances ought not to be prescribed in combination with Squill.

c. GUM-RESINS.

The chemical nature of Gum-Resins has been described; it only remains to speak in detail of those which possess expectorant properties.

1. ASSAFŒTIDA.—The origin of this Gum-Resin has been already traced (p. 513). Dr. Cullen first remarked that, when it is taken into the stomach, it stimulates that organ, and rouses into action the respiratory muscles, so as to aid the expulsion of whatever is accumulated in the pulmonary tubes. From the stimulant nature of Assafœtida, it is evident that it can only be employed when no inflammatory symptoms are present: experience has amply confirmed its efficacy in chronic catarrhs and old asthmatic affections; but, in asthma, much of the benefit derived from it must be ascribed to its power of resolving spasm: it, however, also diminishes excessive bronchial secretion. Perhaps the best form of administering it, as an Expectorant, is that of a pill in combination with ipecacuanha and extract of conium. The dose is from four to twelve grains of the Gum-Resin; but this should be repeated at short intervals.

ASSAFŒTIDA PILLS. *Pilulæ Assafœtidæ.* E. COMPOUND GALBANUM PILLS. *Pilulæ Galbani compositæ.* L. D.—The first is made by beating into a mass, fit for making pills, *three parts* each of Assafœtida, Galbanum, and Myrrh, with four parts of Conserve of Red Roses. In the second, ℥i of Galbanum, ℥iss of Myrrh, ℥iss of Sagapenum, ℨss of Asssafœtida, are beaten up with Syrup (Treacle, D.).

The dose is gr. x to ℈i.

2. AMMONIACUM. *Ammoniacum.* L. E. D.—Although Dioscorides has stated that the plant from which Ammoniacum is obtained is a native of Lybia, and named *Agasyllis*, and Pliny has also noticed it, under the appellation of *Metopiom*, yet both the plant itself and its native soil were equally unknown, until Lieutenant-Colonel Wright, of the Royal Engineers, discovered it in the vicinity of Jezd Kahst, a town of Irak El Ajam, the ancient Parthia, about forty-two miles south of Ispahan. The plant belongs to the natural order Umbelliferæ: a dried specimen, presented to the Linnæan Society by Colonel Wright, enabled Mr. Don to describe it; and, as it is a new genus, he named it *Dorema**. Mr. Don informs us that the plant is not unlike Opopanax, "facie fere opopanacis;" and that the Ammoniacum exudes spontaneously from its surface. The genus Dorema is distinguished from Ferula and Opopanax, to both of which it is closely allied, by a large cup-shaped epigynous disk, completely sessile flowers, and solitary resiniferous

* Dorema, from the Greek δορημα, a gift or benefit.

canals*. The plant is called *Oshac* by the Persians: it is perennial, and grows without cultivation on the plains between Yerdekaust and Kunisha, in the province of Irak, exposed to an ardent sun. The root is perennial; the leaves nearly two feet long, bipinnate, the pinnæ in three pairs, and the leaflets inciso-pinnatifid, with oblong mucronulate, entire, slightly lobed segments, and supported on downy petioles. The flowers are sessile, immersed in wool, in proliferous, racemose umbels, with globose umbellules on short stalks: without either general or partial involucre. The petals are ovate, reflexed at the point; disk large, fleshy, cup-shaped. Fruit elliptical, compressed, buried in wool, surrounded by a broad flat edge. The proper juice "is so abundant, that upon the slightest puncture being made it instantly oozes forth, even at the ends of the leaves. When the plant has attained perfection, innumerable beetles, armed with an anterior and posterior probe of half an inch in length, pierce it in all directions: it soon becomes dry, and the exuded juice, being then in the state of commercial Ammoniacum, is picked off, and sent *via* Bushire to India, whence it is exported to Europe†."

Until these facts, collected by Mr. Don, and some remarks which appeared in the first volume of the Dictionnaire Universel de Matière Médicale, in 1829, were laid before the public, there was much diversity of opinion respecting the Ammoniacum plant. Wildenow regarded it as a species of Heracleum, and named it H. *gummiferum:* Sprengel asserted that it was the Ferula *ferugala* of Desfontaines; Olivier, that it was the Ferula *Persica;* whilst others contended that the plant was the Bubon *gummiferum* of Linnæus: in one point only all agreed, namely, that Ammoniacum is the product of an umbelliferous plant‡.

Ammoniacum is imported in irregular masses, yellow exteriorly, white within, and breaking with a vitreous fracture. The masses are formed of agglutinated tears, which are rarely in a separate state: but they also are yellow on the surface and white within. The odour is faint and unpleasant, the taste bitter, nauseous, and acrid. It is sufficiently brittle to be powdered in a low temperature; but the powder again runs into a mass in warm weather. In a moderate heat it softens and loses five per cent. of its weight, probably water. It is partly soluble in water, forming a milky-looking emulsion; but by rest it deposits four parts of resin, and one of gummy matter remains in solution. The gummy solution reddens the tincture of litmus: and is pre-

* Transactions of the Linnæan Society, 1832.

† Linnæan Trans. l. c. quoted from the Trans. of the Med. Soc. of Calcutta, vol. i, p. 369.

‡ Lindley, 47. Dr. Lindley regards the African Ammoniacum, the *Fashook* of the Barbary coast, to be the production of Ferula *tingitana*. Pereira's Mat. Med. 2nd edit. vol. ii, p. 1465.

cipitated by diacetate of lead and oxalate of ammonia. The resinous part of Ammoniacum resembles wax in many particulars. It unites with alkalies, forming soapy compounds, having considerable bitterness; is dissolved by sulphuric acid, and forms a solution which is decomposed by water. Nitric acid, aided by heat, decomposes it, and produces a yellow resino-bitter substance; and, on evaporating the fluid, it yields more of the resino-bitter, which is partially soluble in hot water, and communicates to wool or to silk a beautiful permanent yellow colour, that resists the action both of chlorine and weak alkaline solutions. According to the analysis of Braconnot, one hundred parts of Ammoniacum contain 18·4 of gum, 70 of resin, 4·4 of a glutinous matter insoluble in water and alcohol, 6 of water, and 1·2 loss, = 100·0*. According to Hagen, the constituents are 68·6 of resin, 19·3 of gum, 5·4 of gluten, 1·6 of extractive, 2·8 of volatile oil and water, and 2·3 of sand, = 100·0†.

When Ammoniacum is taken into the stomach, its impression upon the nerves of that organ is transmitted to the respiratory nerves; at the same time it is absorbed, and operates directly upon the bronchial tissue. As an expectorant, it has been found useful in asthmatic affections, in peripneumonia notha, and in the chronic catarrh of old people. It has been employed in Phthisis; but it is too stimulant for the early stages, and the little probability of any thing proving useful in the advanced stage of that disease renders its employment then of little consequence. It is generally given in conjunction with squill, antimonials, and sedatives. A curious form of prescribing it in conjunction with nitric acid is adopted in America. Two drachms of the gum-resin are triturated with f℈i of nitric acid, diluted with f℥viii of water, until an emulsion be formed. A table-spoonful of this solution is given in any bland vehicle, every two or three hours, in cases of old catarrhs, in which large accumulations of viscid mucus exist in the pulmonary tubes, with feeble and difficult expectoration. I have had no experience of this form of prescribing Ammoniacum; but it may prove useful in chronic cough attended with much weakness, to rouse the feeble powers of the respiratory muscles and enable the lungs to throw off the offending matter. It may be given in conjunction with ammonia; and, in those irritable coughs that accompany hysterical affections and are attendant on dyspeptic and hypochondriacal states of the habit, no other expectorant produces so much benefit. The dose in these cases is from gr. viii to gr. xxx.

Mixture of Ammoniacum, *Mistura Ammoniaci*, L. D. is made by triturating ℈v (℈i, D.) of Ammoniacum with Oi (f℥viii,

* Ann. de Chem. lxviii, p. 69.

† Schwartze, Pharm. Tabel 280, 2te Aufg.

D.) of water (penny royal water, D.) gradually added until a complete emulsion is obtained.

The dose is f℥ss to f℥i.

3. Galbanum. L. E. D.—Mr. Don asserts that the plant which affords Galbanum is not the Bubon *Galbanum* of Linnæus, nor is it the Ferula *Ferulago* of Lobel, but it is one which appears to constitute a new genus, allied to *Siler*, differing, however, from it in the absence of dorsal resiniferous canals, and the commissure being furnished with only two. He proposes to call the plant Galbanum *officinale*. The London College has adopted his opinion, although he had formed it only after having seen the fruit which he has described*. The Edinburgh College refers it to an imperfectly ascertained umbelliferous plant, probably a species of Opoidia†. The plant is probably a native of Persia, as the gum-resin is partly imported from Smyrna, partly from India. It is scarcely necessary to say, that whatever the plant is, it is supposed certainly to belong to the natural order Umbelliferæ.

Galbanum is occasionally in the form of tears, but more frequently these are agglutinated into masses. The tears of both kinds are irregularly oval and globular, yellowish-brown on the outside, translucent, soft, tough, and pulverizable only in cold weather: the odour is peculiar, the taste bitter, acrid and disagreeable. An inferior variety, dark coloured, rather opaque, and more bitter, but less odorous and acrid than the former kind, is also found in the market.

Galbanum is softened by heat; and, when ignited, burns with a clear, white flame, and emits a fragrant odour. Rectified spirit dries up the resin and leaves the gum; proof spirit dissolves the whole. Sulphuric acid also dissolves the resin. The constituents of Galbanum are 66 of resin, 22·6 of gum, 1·8 of bassorin, 3·3 of volatile oil, and 6·5 of impurities, = 100·0‡.

As an Expectorant, Galbanum is supposed to possess properties closely resembling those of Assafœtida: it is prescribed with the same view, that of aiding the expulsion of viscid or irritating matters from the bronchial tubes and cells, in chronic catarrh and humoral asthma. It may be given in doses of from gr. x to ℈ss, in combination with ipecacuanha and any narcotic, two or three times a day.

4. Sagapenum. L. D.—This substance, the source of which is still uncertain, although it has been attributed to the Ferula *Persica*, is brought from the Levant, in masses of a reddish-brown colour, soft and semi-diaphanous. Its odour is disagreeable, somewhat resembling that of weak assafœtida: its taste is acrid and slightly bitter. According to the analysis of Pelletier,

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* Trans. of the Linnæan Society, 1832.

† Lindley, 51.

‡ Meissner.

it consists of 27·13 parts of resin, + 15·97 of gum, + 0·80 of insoluble gum and other matter, + 0·20 of malate of lime, + 5·90 of volatile oil; but, according to Brandes, it contains 50·3 of resin, + 37·2 of gum, + 3·7 of volatile oil. It operates as a stimulating Expectorant; but it possesses no advantages over assafœtida, is inferior to ammoniacum, and has been justly rejected from the Edinburgh Pharmacopœia. The dose is from gr. vi to gr. xii.

5. Myrrh. L. E. D.—Under the head of Tonics, some account is given of this gum-resin; but I may here add, that besides the resin and gum, which make up the greater part of it, a free acid, which is supposed to be the carbonic, holding lime in solution, is found: this carbonate effervesces with sulphuric acid, and is precipitated by oxalate of ammonia.

The expectorant property of Myrrh, although on its account the gum-resin is very commonly employed in pulmonary diseases, yet, is doubted by some physicians. I have never observed it produce any beneficial effects when it is given alone. The use of Myrrh is chiefly indicated in chronic coughs and catarrhal affections of debilitated habits, when other and more decided Expectorants are conjoined with it; such, for example, as ipecacuanha or squill; but in these cases more is due to its tonic than to its expectorant properties. It is undoubtedly stimulant, and therefore ought never to be employed when decided inflammatory symptoms are present. In the advanced stages of phthisis, Myrrh is daily prescribed; and as it is in such cases that chlorine gas is most useful, I am disposed to recommend Myrrh as the best medicine for propping the habit during the topical use of chlorine. It can only be regarded as an auxiliary in phthisis. In prescribing it, we must bear in recollection that its aqueous solution precipitates all the salts of lead and of mercury; and consequently that they are incompatible in prescriptions with it. In phthisis, it may be advantageously combined with sulphate of zinc; and when there is much acidity of stomach, the gum-resin may be dissolved in liquor potassæ or liquor ammoniæ, and administered in any bland aqueous solution. Its efficacy is well established in chronic catarrh and humoral asthma, in which its tonic property, in counteracting the exhaustion produced by profuse expectoration, is highly beneficial. The dose of Myrrh, as an auxiliary to Expectorants, in such cases, is from four to eight grains, repeated every three or four hours.

d. BALSAMS.

The characters which distinguish a Balsam are its containing *resin, benzoic* acid, and *volatile oil.* The general properties and appearances of a Balsam are those of the resins; but when it is heated, or is digested in an acid, benzoic acid is procured. Although

it has been doubted whether this be the production of the process by which it is obtained, or whether it exists ready formed in the Balsam, yet, as water dissolves the acid part of Balsams, it is probable that the acid exists ready formed in them. Alcohol and ether readily dissolve them. The strong acids dissolve them, and during the solution a portion of benzoic acid is separated. The resin of the Balsams differs from common resin*. The purest common resin dissolves in sulphuric acid, affording a yellowish or reddish-brown solution, which precipitates whitish flocculi when dropped into water: the resin of the Balsams produces a beautiful red or deep crimson solution with sulphuric acid; and, when this is dropped into water, the precipitate consists of beautiful rose-red or crimson flocculi, which, when washed, do not contain any sulphuric acid; a fact demonstrated by nitrate of baryta, which, even when boiled over them, forms no sulphate of baryta. By heating any Balsam to expel the benzoic acid, and then dissolving the residue in concentrated sulphuric acid, and precipitating it with water, the purity of the Balsam is readily ascertained by the colour of the precipitate.

The Balsams are of different consistence; some being solid, as Tolu Benzoin and Storax, others of a semifluid consistence, as that of Peru.

6. Balsam of Tolu. *Balsamum Tolutanum.* L. E. D. Balsam of Peru. *Balsamum Peruvianum.* L. E. D.—The former of these Balsams was formerly said to be the secretion of the Toluifera *Balsamum* of Linnæus; but in truth the genus Toluifera has been proved by Humboldt to have been founded on false documents, and, consequently, it does not exist. The pale-coloured Balsam, which derives its name from the town of Tolu, in South America, near which it grows, is the produce of the Myroxylon *Toluifera*, the Myrospermum *Toluiferum* of De Candolle, a tree so nearly allied to that which yields the red Peruvian Balsam, Myrospermum *Peruiferum*†, that it was, with some probability, asserted to be the same tree—an opinion which Nees von Essenbeck has called in question. It differs in the form of the leaflets, which are thin, membranous, ovate, and acuminate, the terminal one being the largest; whereas, in M. *Peruiferum*, the leaflets are coriaceous, ovato-lanceolate, and the terminal one not larger than the rest. This species of Myrospermum is a native of the warmer regions of South America, growing in the forests of Paxaten, Muna, Cuchero, and near Villa Tucasuan. The Peruvian Balsam is referred, by De Candolle, to the Myrospermum *Peruiferum*, a tree growing in the forests on the banks of the river Muranon; and also near Bogota, in Colombia. The genus Myrospermum belongs to the

* This remark was first made by M. Dulong d'Astafort.—Journ. Pharm. 1826, p 37.

† Woodville's Med. Bot. third edition, vol. v, p. 48. Richard, Hist. Nat. Med. t. ii, p 509. Nees Von Essenbeck, 321, 322 Lindley, 279.

natural order Amyridaceæ. The character of the Balsam yielded by these trees is greatly modified by circumstances. When it is procured by incisions at the commencement of spring, "when the showers are frequent, short, and gentle," the Balsam is white, and being collected in bottles, remains liquid for many years, and forms the white Balsam of Peru; when it is deposited in calabashes, it condenses and hardens, and forms the dry Balsam, which is named *Balsam of Tolu.* When the bark Myrospermum *Peruiferum* of De Candolle is boiled in water, or distilled per descensum*, the product is the dark liquid termed *Balsam of Peru.*

1. *Balsam of Tolu* is generally brought to this country in calabashes: its odour is extremely fragrant, somewhat resembling that of lemons; its taste resinous, aromatic, and somewhat sweetish. In distillation, it yields a small portion of volatile oil, and benzoic acid sublimes. According to Tromsdorff, it contains 87·8 parts of resin, 12 of benzoic acid, and 0·2 of volatile oil, = 100·0. When digested in sulphuric or in nitric acid, much benzoic acid sublimes; and when nitric acid is employed, traces also of hydrocyanic acid are evolved. It is wholly soluble in alcohol, rectified spirit, ether, and the alkalies: when dissolved in a small quantity of the solution of potassa, it loses its natural odour, and acquires that of the clove pink. It forms the chief ingredient in two pharmaceutical preparations: a *tincture*, which is a simple solution of the Balsam in rectified spirits of wine, which requires to be rubbed with mucilage before it can be rendered miscible with water; and a *syrup.* It is also a component of the *compound tincture of benzoin.* In all of these preparations, the Balsam of Tolu operates as a stimulant Expectorant; and, therefore, it can only be administered in chronic catarrh and asthma, when it is necessary to rouse the energy of the lungs and respiratory organs, to promote the expectorant effort. In an opposite condition of the chest, Balsam of Tolu is undoubtedly contraindicated, although the syrup, in the small quantity in which it is used to communicate taste and flavour to pectoral mixtures, may be even then administered.

TINCTURE OF BALSAM OF TOLU. *Tinctura Balsami Tolutani.* L. D. *Tinctura Tolutana.* E.—In the London Pharmacopœia, it is ordered to be prepared by macerating ℥ii of Balsam of Tolu in Oii of rectified spirit till the balsam is dissolved, and filtering the solution. The Edinburgh and Dublin Colleges direct ℥iii (℥i, D.) of the Balsam in coarse powder to be digested in Oii (f℥xvi, D.) of rectified spirit, until the solution is complete, when it must be filtered.

This tincture is decomposed by water: in prescribing it, therefore, its suspension in that fluid should be procured by triturating it with Acacia gum. The dose is fʒss to fʒi.

* Martius affirms that it is obtained by that kind of distillation.

SYRUP OF TOLU. *Syrupus Tolutanus.* L. E. D. — The London College orders ℥x of the Balsam of Tolu to be boiled in Oi of boiling water for half an hour in a loosely covered vessel, shaking it occasionally, then filtering and adding to the liquor lb. ss of sugar. The Edinburgh and Dublin Colleges add ℥i of the Tincture of Tolu gradually to lb. ii (lb. iss, D.) of simple syrup, not quite cold, agitating briskly. This is an agreeable addition to Pectoral Mixtures, in doses of f℥i to f℥ii.

2. *Balsam of Peru* is a viscid, deep reddish-brown coloured fluid, somewhat of the consistence of fluid honey, having a fragrant odour, and a warm, acrid, aromatic, bitterish taste. Its density is 1155; it remains fluid in the air. When boiled in water for some time, the water becomes acidulated, and deposites, on cooling, crystals of benzoic acid. When distilled with water, it yields a reddish limpid oil; and benzoic acid sublimes in the neck of the retort. When distilled pure, scarcely any oil is obtained: but if the heat be raised to 617°, a yellowish oil comes over abundantly, and benzoic acid sublimes; at a lower heat, the products are an acid, water, and a dirty-looking benzoic acid. If the heat exceed 617°, the Balsam is completely decomposed, and a black, pitchy, empyreumatic oil, with plenty of carbonic acid and carburetted hydrogen gas, come over.

Sulphuric acid acts upon Balsam of Peru in the same manner as upon other Balsams. Nitric acid acts upon it with violence; but when the acid is diluted and distilled with Balsam of Peru, the liquid in the receiver smells of bitter almonds, and, when treated with potassa, solution of protosulphate of iron, and hydrochloric acid, it shows evident traces of hydrocyanic acid. In this case, both the nitric and the benzoic acids are decomposed; the equivalent of nitrogen necessary to form the hydrocyanic acid is supplied by the nitric acid, whilst the carbon and the hydrogen proceed from the benzoic.

According to the analysis of Stolze, this balsam consists of 24 parts of brown, nearly insoluble resin; 207 of soluble resin; 690 of a volatile oil; 64 of benzoic acid; and 6 of extractive, in 1000 parts. It may be given to the extent of f℥i, triturated with yolk of egg, or powder of Acacia gum, to suspend it in water. It is a more stimulant Expectorant than balsam of Tolu; it is occasionally, but not often, employed in asthma of old and debilitated persons; but it is chiefly used externally, to cleanse ulcers, and promote their healthy granulation.

4. STORAX. *Styrax.* L. E. D.—This balsam, when pure, is a spontaneous exudation from the bark of the Styrax *officinale**, a native of Arabia, Syria, the Greek islands, Italy, and the South

* Woodvlle's Med. Bot. 3rd edit. p. 201, pl. 101. Richard, Hist. Nat. Med. t. ii, p. 158. Hayne, xi, 23. Lindley, 390.

of Europe. The tree belongs to the natural order Styraceæ. The Storax is said to be procured by incisions made into the trunk of the tree. Pure Storax is in concrete tears, of a yellowish or reddish-yellow hue, having the consistence of wax, and an agreeable odour. It is now rare in the market.

The Red or common Storax, or, as it is called, Storax in mass, is of a clear reddish-brown colour, and consists of agglutinated masses, which are clammy when handled. It has an odour not unlike that of Balsam of Peru, and a warm aromatic taste. It contains many impurities, especially sawdust. Both varieties are inflammable, and possess the general properties of the other balsams. It is stated, by Reinsch, to consist of from 33 to 54 per cent. of resin, + 1 to 2·6 of benzoic acid, with a trace of volatile oil, some extractive, and much woody fibre. Storax is a stimulant Expectorant; but it is a useless incumbrance of the Materia Medica; all the advantages which it possesses being more amply obtained from the Balsams of Peru and Tolu.

5. BENZOIN. *Benzoinum.* L. E. D.—Benzoic Acid has been already noticed in its separate state (p. 805). Benzoin is the production of the Styrax *Benzoin**, a plant belonging to the natural order Styraceæ. This tree grows in the northern parts of Sumatra, named the *Batta* country. On some parts of the coast it is cultivated, being a quick-growing tree. The seeds are sown in the paddee fields; and, when the trees acquire trunks of six or eight inches in diameter, incisions are made in the bark, from which the Benzoin exudes, and is pared off with a knife. The first portion is the purest: it is white, soft, and fragrant, and is called *Head* or *Pahong Benzoin;* the next is mixed with parings of the wood, and is called *Belly Benzoin;* and the least pure, which is very foul, is named *Foot Benzoin.* The trees will bear three incisions, after which they are exhausted and die. The best Benzoin is sent to Europe; the rest is used in India and the Malay islands, for burning to perfume the houses, and to expel troublesome insects. Two varieties are known in England under the appellation first and second.

The best Benzoin is in dry, pulverulent masses, of a pale reddish-brown colour, spotted with clear red, and intermixed with numerous small amygdaloid masses, or whitish tears, about the size and shape of an almond, presenting an even, translucent fracture. It has a sweetish, balsamic taste, and an aromatic, agreeable odour. Its sp. gr. is 1·068. The second kind is of a dingy reddish-brown colour. Both are pulverizable, take fire, and throw out an irritating smoke; and both yield Benzoic acid, when treated as formerly described. According to the analysis of M. Bucholz, Benzoin contains resin, benzoic acid, a substance

* Woodville's Med. Bot. p. 294, pl. 102. London Dispensatory, art. Styrax. Richard, Hist. Nat. Med. t. ii, p. 160. Hayne, xi, 24. Lindley, 390.

analogous to balsam of Peru, and a peculiar aromatic principle, soluble in water and alcohol, ligneous matter, and impurities. Stolze analysed the tears and their connecting mass separately, and found the following matters in 1000 parts of each.

	Tears.	Mass.
Yellow resin, soluble in pure ether....	798·25	88·00
Brown resin, insoluble in pure ether .	2·50	697·25
Benzoic acid	198·00	197·00
Extractive	0·00	1·50
Impurities	0·00	14·50
Moisture and loss	1·25	1·75

Benzoin is wholly soluble in alcohol and in the solution of potassa; and when the latter is poured on it in a boiling state, crystals of benzoate of potassa are mixed with the solution, and separates as it cools. It is soluble in boiling nitric acid: but, on cooling, a copious deposite of benzoic acid takes place. By digestion in strong nitric or sulphuric acid, it is converted into artificial tannic acid. When it is exposed to heat, the benzoic acid is exhaled in combination with a small quantity of aromatic oil, which gives it odour.

As a stimulant Expectorant, Benzoin is advantageously employed in humoral asthma; but its effects do not differ from those of the other balsams. It is commonly administered in the form of Tincture.

COMPOUND TINCTURE OF BENZOIN. *Tinctura Benzoini composita.* L. E. D.—According to the London and Dublin Colleges, it is prepared by macerating ℥iiiss of Benzoin, ℥iiss of purified Storax, and ʒv of Aloes, in Oii of Rectified Spirit, for fourteen (seven, D.) days, and filtering. The Edinburgh College orders ℥iv of coarsely powdered Benzoin, ℥iiss of Balsam of Peru, and ʒiv of East Indian Aloes, to be digested for seven days in Oii of rectified spirits. The clear liquor to be poured off and filtered.

The dose of this Tincture is fʒss to fʒi; it requires to be rubbed up with powder or mucilage of Acacia gum, when it is ordered to be given in any aqueous fluid.

All the balsams were formerly much employed as Expectorants in pulmonic diseases, whether recent or chronic; whether pleuritic or asthmatic; pneumonic or phthisical. But there are, doubtless, unanswerable objections to the employment of balsamic medicines in the inflammatory stage of any pulmonary disease. Dr. Fothergil loudly denounced the use of them in such cases; but perhaps he carried his objections too far. Experience has demonstrated that, when the excitement is subdued, they may be employed with advantage. The best form of giving them is to suspend them in water by triturating them with sugar and yolk of egg. The mildest is the balsam of Tolu. An elegant mixture is formed by rubbing from forty to fifty drops of the

tincture with mucilage of Acacia gum, which renders it miscible in water. This emulsion is an excellent vehicle for the compound powder of ipecacuanha in obstinate coughs, when all inflammatory symptoms have subsided.

e. OLEO-RESINS.

These are the proper juices of those plants which constitute the natural order Coniferæ, Amyridaceæ, and some of the Leguminosæ: they are natural compounds of volatile oil and resin.

COPAIVA. *Copaiba.* L. E. RESINA COPAIFERÆ OFFICINALIS. D. — This oleo-resin is the production of different species of Copaifera. The Copaifera *officinalis** furnishes an inferior Copaiva; and the best is said to be the production of C. *multijuga* and C. *Martii.* The London College designates the C. *Langsdorfii* as the source of the Copaiva. The C. *multijuga* and C. *Martii* are natives of Peru: the former is a large tree, and yields the greatest quantity of the oleo-resin. It is obtained from incisions made in the trunk. The genus belongs to the natural order Amyridaceæ. From the incisions in the bark of the trunk it flows so abundantly that twelve pounds are often procured in three hours.

Copaiva is of a bright-yellowish colour, of the consistence of thick oil, transparent, and lighter than water; it has a strong, disagreeable odour; an acrid, bitter taste; and a sp. gr. of 950. By distillation, it yields a greenish-white, transparent, volatile oil, which has the odour of Copaiva, and to which it owes much of its medicinal powers; whilst a reddish-brown, solid, transparent, inodorous resin is left in the retort. This oil is now made officinal by the Edinburgh College, under the name *Oleum Copaibæ.* According to the analysis of Stolze, 100 parts of Copaiva contain 45·79 of volatile oil, + 1·66 of a clammy resin, + 52 of brittle resin, and 0.75 of extractive. The quantity of volatile oil is diminished by keeping the Copaiva. Gerber found 41 per cent. in a recent specimen, and only 31.70 in an old one; the resins were of course in greater quantity†. It is soluble in strong alcohol, ether, and the volatile and fixed oils; but insoluble in water, in which, however, it can be suspended by yolk of egg. It is often adulterated with turpentine and castor oil, the former of which may be detected from the odour when heated; the latter by mixing three parts of the suspected Copaiva with one of sulphuric acid; if the Copaiva be pure, it forms a plastic, reddish mass.

The resin, separated from the volatile oil, consists of a soft, viscid resin, and a peculiar acid, which has been named *Copaivic.*

* Woodville's Med. Bot. 3rd edit. p. 609, pl. 216. London Dispensatory, art. Copaifera Richard, Hist. Nat. Med. t. ii, p. 506. Lindley, 278.

† Journ. de Pharm. xvi, 79, 367.

It is crystallizable, soluble in alcohol and ether, and in both the fixed and the volatile oils. Its spirituous solution reddens litmus, and it forms copaivates with the oxides and with ammonia. It is a compound of $C.^{40}$ $H.^{32}$ $O.^{4}$

Copaiva has been prescribed successfully as an expectorant in chronic catarrh, with the view of inspissating, rather than attenuating, the mucus of the bronchial tubes. If, as is probable, it stimulates directly the mucous membrane, the effect produced may arise from a new action being induced upon the inflamed surface, in somewhat the same manner as occurs, from its employment in gleet on the mucous membrane of the urethra: and it is only upon such a mode of action that we can account for the benefit which results from its administration in the advanced stages of phthisis. The average dose is from m. xx to f℥i, combined with sugar and any bland fluid as an oleo-saccharum. It may also be given in the form of pills, by rubbing it up in the proportion of two parts of Copaiva with one part of the carbonate of magnesia, and leaving the mixture for some time at rest, until it become solid; if the Copaiva be pure, the mass remains diaphanous.

As the taste is extremely disagreeable to many persons, M. Mothe, a Frenchman, has invented a method of inclosing the oleo-resin in a gelatin capsule, containing g. x of the Copaiva. This covers the taste; but the definite dose is one objection to the general use of these capsules.

Oil of Copaiva. *Oleum Copaibæ*. E.—This is procured by distilling ℥i of Copaiva with Oiss of water, returning the water into the still and redistilling as long as any oil passes over. This oil is colourless and transparent; has an acrid taste, and the odour of Copaiva. It is a compound of Carbon and Hydrogen ($C.^{10}$ $H.^{8}$), and is so free from Oxygen, that Potassium may be preserved in it. The dose is m. x to f℥i; but it does not exert the same salutary influence as the Copaiva.

f. BITTER EXTRACTIVE.

The substances to be described under this head are little used; but, nevertheless, they possess considerable expectorant powers.

1. White Horehound. *Marrubium**. L. D.—This is the dried plant of *Marrubium vulgare*, an indigenous plant, found as a weed under every hedge, and belonging to the natural order Labiatæ. The whole plant is covered with a hoary pubescence; the stems are quadrangular; the lower leaves stalked, the upper sessile, crenate, and the surface is wrinkled and veiny, but soft.

* This species of Marrubium should not be confounded with Marrubium *nigrum*. Vide Woodville's Med. Bot. third edit. p. 331, pl. 118. Richard, Hist. Nat. Med. t. ii, p. 51. Lindley, 494.

The flowers are in dense, convex whorls, white, with a tubular calyx, the lip spreading into ten rigid teeth, each alternate one smaller than the others. Besides extractive, Marrubium contains volatile oil, on which its strong and unpleasant odour depends: but it is only in the recent plant of Marrubium that this strong musk-like odour chiefly exists: it is soon lost when the plant is dried and kept. Marrubium has a bitter, slightly acrid taste: its medicinal properties evidently depend on bitter extractive and volatile oil; but it contains also resin and tannic acid. Water takes up a considerable portion of these components, and along with them the tannic acid; hence persulphate of iron throws down a greenish-black precipitate when added to the watery infusion, which also precipitates nitrate of silver, bichloride of mercury, and the salts of lead. As it is precipitated, also, by oxalate of ammonia, lime is one of its constituents; and it is probable that the lime is in the form of a carbonate, as barytic salts throw down a precipitate, which is soluble in nitric acid.

The employment of this plant as an Expectorant is of very ancient date. It was commonly employed in humoral asthma, when accompanied with much oppression, and with a tough, ropy, expectorated matter, difficult to be thrown off, or causing pain in its expectoration. Alexander Tralles recommends it greatly in phthisis: but, although I cannot accord with his eulogy of it in this cruel disease, yet it produces considerable benefit in that state of chest which has been named catarrhal phthisis, in which there is much cough, with copious excretion of mucus, a diurnal fever, recurring twice a day, nocturnal sweats, and great prostration of strength. In this state, in which a tonic is clearly indicated, the Horehound may be prescribed with advantage. It may be administered in the form of powder, mixed with the syrup of white poppies, or in the form of an aqueous or a vinous infusion. On the Continent an extract is prepared; but it is much less useful than the other preparations of the herb, owing to the dissipation of the volatile oil. The infusion, made with ℥i of the dried plant to half a pint of boiling water, may be given in doses of f℥ii three times a day.

2. Coltsfoot. *Tussilago.* L. D.—This indigenous plant has been much neglected by the moderns, although it held a high rank as a pectoral among the ancients. The Tussilago *Farfara** belongs to the natural order Asteraceæ. The plant is found in great abundance on waste grounds of a chalky and argilaceous character, propagating itself by rhizomes, or underground creeping rootstocks†. The flower heads appear before the leaves, each being on a simple, round, woolly, scaly, radical stalk, co-

* Woodvilles's Med. Bot. third edit. p. 45, pl. 68. London Dispensatory, art. Tussilago. Richard, Hist. Nat. Med. t. ii, p. 256. Hayne, ii. 16. Lindley, 458.

† It is this plant which shows itself when earth is thrown up from a great depth, as in digging wells, &c.

vered with reddish, smooth, scattered bracts. The leaves, which are on channelled petioles, are cordate, annular, and sharply toothed, glaucous above and white beneath, with prominent veins. The flowers are yellow. The dried plant yields its medicinal properties to water: the decoction or infusion of the leaves strikes a greenish-black colour with sesquisalts of iron. It is copiously precipitated by diacetate of lead and oxalate of ammonia; but it is little affected by any other reagent: hence we may regard its constituents to be *gum, tannic acid, bitter extractive*, and *salts of lime.* Its active principle is unknown; but it is conjoined with a pure bitter, to which must be attributed its influence as a tonic, in combination with its expectorant power. The decoction of Tussilago was a remedy for phthisis so early as the time of Dioscorides; but it is now seldom prescribed: it nevertheless has properties which require the attention of the physician. As a tonic, it may be employed in the latter stages of phthisis and chronic catarrh. I can bear ample testimony to its expectorant powers. In making the decoction, care must be taken to strain it carefully, as the hairs of the pappus of the flowers may be taken into the gullet, and produce much injurious irritation there. The decoction is made with two ounces of the dried plant to a pint of water, and may be administered in doses of from f℥iss to f℥ii three times a day.

3. Iceland Moss. *Cetraria Islandica.* L. E. D. (p. 578).—As it is to the bitter principle that this lichen owes its medicinal properties, it is probable that that principle enters the circulation and stimulates the pulmonary exhalants. I have doubts, however, of its Expectorant influence; although it has been vaunted as a *Pectoral* for more than 200 years. Scopoli, Dr. Herz, Schneider, a Danish physician, Stoll, Tromsdorff, and a long list of physicians of Germany, have published their testimony to its efficacy in phthisis: but, still, it must be regarded rather as a tonic of a light kind, in combination with a feculacious nutriment, than as an Expectorant. A correct idea of its value in phthisis may be given in the words of Sir Alexander Chrichton. "In phthisis," says he, "its good effects consist in improving the matter to be expectorated; in diminishing the frequency of the cough, and rendering it more easy: in calming the irritability of the patient, and in preventing, or much moderating, hectic fever." In prescribing it, the bitter should not be ordered to be wholly removed, but only as much of it as can be taken up by cold water, in which the lichen should be steeped for twelve hours; after which the water should be decanted off, and the residue squeezed between the folds of a coarse cloth: it should then be boiled with fresh distilled water, until the whole assume a smooth, gelatinous consistence. When this decoction is strained, it consists of starch, holding in solution a considerable portion of bitter extractive, and some traces of an acid which has been

named *Lichenic*, and which forms reddish precipitates with salts of iron. Its constituents are $C.^4\ H.^2\ O.^2$* The best form of administering this decoction is to combine it with some of the mineral acids, and to sweeten it with syrup of white poppies. In this form, it may be freely administered in cases in which the powers of life are sinking.

* * *Inorganic Substances.*

AMMONIA. L. E. D. SESQUICARBONATE OF AMMONIA. L. E. D.—In mentioning the topical effects of Ammonia when taken into the lungs in the form of vapour, I stated its utility as arising from the stimulus which it affords to the mucous membrane when in a highly relaxed state; and that, by calling into action the respiratory muscles, it enables the patient to expel from the lungs the superabundant mucus which obstructs respiration and destroys life by suffocation. There is much risk, however, in the topical application of Ammonia in this manner; and therefore its internal administration is always to be preferred. It exerts an immediate and powerful influence on the animal œconomy, when it is taken into the stomach; its influence being exerted on the nervous system, without quickening or much increasing the force of the heart and arterial system. In the latter stage of inflammation of the lungs, when the expectoration suddenly stops, and suffocation is threatened, Sesquicarbonate of Ammonia is the best medicine to restore the power of expectorating, and to maintain the nervous energy necessary for that effort. The dose may be regulated according to circumstances:—it may be extended to ten, or even, occasionally, to sixteen grains, repeated every second hour, until the effect is produced; when the dose must be again diminished and the interval extended. The chief inconvenience in the administration of such large doses of the medicine arises from the heat it excites in the fauces in the act of swallowing it; and, therefore, it is requisite to involve it in some mucilaginous substance; the best, perhaps, is simple mucilage of gum, diluted with the emulsion of almonds.

Substances which operate as Expectorants by producing Nausea.

* *Organic Products.*

a. EMETINA and IPECACUANHA.—The nature of these substances has been already detailed (p. 737, 739). In attempting to explain the mode by which nauseating medicines produce expectoration, we must consider the sympathy which exists between the skin and mucous membrane of the pulmonary

* Ann. de Chem. xc, p. 227.

tubes, and the similarity of the functions of both as exhalant organs. In febrile and inflammatory states of the system, both the skin and the bronchial membrane suffer constriction capable of impeding their exhalant function, and giving origin to a train of symptoms depending on a deficiency of the natural secretion. In this condition of the mucous membrane, nauseating substances operate by relaxing this constriction, and enabling the secretion to proceed. Under such a state, it is probable that the mucus present in the air tubes is of an acrid character; but as it remains adherent, it excites no effort for its expulsion. When, however, the constriction is relaxed, and the mucus becomes diluted and moveable, it still remains sufficiently acrid to stimulate the glottis and larynx, and thus to call into sympathetic action the whole of the respiratory muscles requisite for the effort of coughing, to expel the now loosened mucus. To effect this purpose, the Emetina, either in its pure state or in combination, as it is found in Ipecacuanha, is well calculated. In its uncombined state, it has not been internally administered in this country; but on the Continent it has been given, in doses of a quarter of a grain, in combination with syrup of Tolu. For expectorant purposes, however, Ipecacuanha is preferable to Emetina, both on account of the manner in which the active principle is sheathed in the powder of the root, and also because the Emetina has been found more likely to excite, in some individuals, inflammatory action in the stomach than Ipecacuanha. This active principle appears to be separated, by the digestive process, from the other components of Ipecacuanha, and then taken into the habit: it passes to the lungs and produces a direct impression upon the pulmonary tissue. The dose of the powder of Ipecacuanha, to produce expectorant effects, is from one grain to two grains; but much depends on the nature of the vehicle in which it is administered. It cannot be administered in combination with any astringent infusion, as tannic acid forms with it an insoluble compound, which exerts no influence whatsoever on the living system.

Syrup of Ipecacuanha, *Syrupus Ipecacuanhæ*, E., is made by digesting ℥iv of Ipecacuanha, in coarse powder, in f℥xv of rectified spirit, with a moderate heat, for twenty-four hours, then pressing, straining, and filtering the liquor; repeating the process on the residuum with f℥xiv of proof spirit; and again with the same quantity of water. The fluids are now to be mixed, and the spirit distilled off till f℥ii remain, to which f℥v of rectified spirit and Ovii of simple syrup are to be added.

This process is a modification of one proposed by MM. Guibourt and Henry. Two fluid scruples contain about one grain of Ipecacuanha. The dose, as an Expectorant, is fℨi to fℨii.

* * *Inorganic Substances.*

b. ANTIMONIALS.—The best of these, for expectorant purposes, are the *Potassio-tartrate of Antimony* (p. 749), and the *Oxy-Sulphuret of Antimony* (p. 749). The nausea which both of these medicines excite relaxing the spasm of the capillaries of the mucous membrane, and permitting the exhalation to proceed, easily accounts for the dilution of the viscid mucus, and the production of that state in which it is most readily expectorated. Now, although this explanation of the action of the nauseating antimonials is satisfactory to a certain extent, as far as regards the pulmonary exhalants, yet, it is evident that the result would be much facilitated by administering, at the same time, the carbonate of ammonia, when the habit admits of it; by which means both the indications can be at once fulfilled—the viscid mucus is diluted, and the means of expelling it by coughing greatly aided.

The *Oxy-Sulphuret* was formerly much employed in asthma and chronic catarrh; but the uncertainty of its operation narrows the chances of its beneficial influence: the *Potassio-tartrate* is undoubtedly a more manageable and active preparation, and answers every purpose which can be expected from Antimonials. For producing its expectorating effect, it is given in minute doses —for instance, from $\frac{1}{16}$ to $\frac{1}{4}$ of a grain, repeated every second hour. It is best given in solution. To secure its operation, the body should be kept moderately warm; for cold on the surface checks its expectorating influence. Squill and other vegetable Expectorants do not materially improve the powers of the tartarized antimony when combined with it. The Potassio-Tartrate should be free from adulteration.

In employing the different Expectorants, frequent occasions occur for conjoining opium with them. In these combinations, opium operates solely by its sedative influence: it certainly does not diminish the bronchial exhalation, as has frequently, but erroneously, been stated: on the contrary, it facilitates expectoration. This is to be attributed both to its increasing the natural exhalation of the lungs, and to its rendering the cough less frequent: and thereby diminishing the irritation which exists on the mucous membrane.

EMPLOYMENT OF EXPECTORANTS AS REMEDIAL AGENTS.

If we compare the class of Expectorants with many of the other classes of medicines, the range of their utility is extremely limited; being confined to the removal of one sympton only in those pulmonary affections in which the respiration is impeded. It is, nevertheless, necessary that the employment of them should be properly regulated. Before prescribing an Expectorant, we must carefully consider upon what grounds we are to select the

substance we intend to employ. We are aware that there are four distinct descriptions of Expectorants, which operate by their stimulant properties, whether these act *directly* by an immediate impression upon the bronchial membrane, or *indirectly* through the medium of the system; which take off the constriction and diminish excitement in the pulmonary agents, and hence operate by exciting nausea. Now, the circumstances that should induce us to select our Expectorant from either of these classes must be connected with the nature of the disease affecting the pulmonary organs;—its exciting cause;—and the consideration whether it be a cough of inflammation and increased action, or whether it be connected with debility, and, in that case, be kept up by nervous irritation. In every pulmonary disease there is reason for thinking that the early symptoms are those of inflammation: Expectorants are then of little importance, except as auxiliaries in bringing on a crisis; but when this is overcome, or partly subdued, then the most salutary effects are obtained from expectoration. In this stage of pulmonary inflammation, the nauseating Expectorants are to be preferred. After expectoration, however, has been induced, and the inflammatory symptoms have been subdued, it is still requisite to continue the use of the nauseating Expectorants; for, as absorption is greatly promoted by nausea, it is necessary to relieve the chest of the superabundant mucus which, at this period, is poured out into the bronchial cells; and, therefore, those stimulants that experience has taught us are chiefly determined to the lungs, must be resorted to for the purpose of throwing off the burthen of mucus with which these organs are oppressed. It is easy to conceive that thickened, or, as they are termed, well-concocted sputa, which are generally sufficiently glutinous to adhere together in masses, will be more easily detached and ejected by a violent expiratory effort, than thin mucus, whether accumulated in the tubes or spread out upon their sides. The necessity, therefore, of ascertaining whether the disease be one of excitement or of debility, is essential: it is necessary also to take into consideration the period of the attack, whether it be the commencement, the middle, or the termination, for which we are called upon to prescribe: for although each of these periods may be benefited by expectoration, yet the substances employed to effect this require to be different in their characters, according to the period at which they are administered.

If we take Pneumonia, or inflammation of the parenchyma of the lungs, as the type of these diseases, we find that it is chiefly characterized by fever, accompanied with pain, more or less severe, in some part of the chest, quickened, sometimes oppressed breathing; cough, which increases the pain and is attended with a viscid, rusty-coloured expectoration. If percussion be employed, we find dulness of sound in some part of the

chest; and, with the stethoscope, the crepitant rhonchus is at first perceived; then bronchial respiration; and bronchophony afterwards. For the advantage of those unacquainted with the use of the stethoscope, it may be necessary to explain that the crepitant rhoncus is a sound as if small bubbles of air were passing through a watery fluid, in the smaller bronchi and air cells; or a sound closely resembling that which occurs from pressure of a healthy lung, in post-mortem dissections: and this is mixed with a hissing or faint whistling sound. Bronchophony is the development of the voice in parts of the lungs where it does not exist in health, as heard through the stethoscope. It is a valuable sign in Pneumonia, in which it demonstrates the exact site of the inflammation. It is most evident when this exists near the roots of the lungs, and in the upper lobes where the bronchi are largest; and more obscure and much less frequent, when the inflammation is in the lower lobes. At first, the cough is dry; but in twenty-four hours, or between that time and forty-eight hours, expectoration comes on. The sputa are of a *rusty* tinge, semitransparent, tenacious, often so much so that the vessel containing them may be inverted without their being detached. If the disease decline in violence, the expectoration becomes less viscid and brown, and more abundant, and sometimes so copious as to prove critical. If, on the contrary, the disease is about to terminate fatally; as the strength fails, the cough becomes less and less capable of expectorating the sputa; and this is, generally, at length totally suppressed for some hours before death. Sometimes, however, the sputa are only changed in their character, displaying occasionally purulent specks, or a greenish, or dirty red colour, with a putrid fœtor, increasing as the pulse becomes thready and intermittent. The countenance then becomes cadaverous and livid, and bedewed with a cold sweat; the lips livid; the breathing gasping, with rattling in the throat; and the patient dies asphyxiated. This general description of the disease is sufficient for illustrating the utility of expectorants in its treatment.

During the early period, when the skin is hot and the pulse sharp, the secretion of the inflamed lungs is not such as to demand the aid of this class of medicines; and it is not until the inflammatory action of the pulmonary vessels be reduced, in the advanced stage of the disease, that it becomes important, often indeed essential for the life of the patient, to promote expectoration. If weakness supervene, with great embarrassment of breathing, Ammonia, very largely diluted with common air, may be inhaled; but the Carbonate is more generally administered as an internal remedy, and often snatches the patient from the most imminent danger. It may be given in doses of gr. v to gr. xii, every hour or two hours, in decoction of Senega root. It rouses the nervous energy, without exciting in an equal ratio the action

of the heart and arteries. When the urgency of the symptoms abate under this treatment, the dose should be gradually diminished; and as the sensibility returns, it may be involved in some mucilaginous fluid. When the disease occurs in old people, promoting expectoration by Ammonia is a still more important part of the treatment, and may be commenced earlier than in ordinary cases. Sometimes it is requisite, for a considerable time after all danger is over, to keep up a free exeretive-secretion from the bronchi, in order to aid the dispersion of solid deposites in the tissue of the lungs: but, for this purpose, less active Expectorants than Ammonia are indicated; such, for example, as a combination of equal parts of Tincture of Squills and Wine of Ipecacuanha, administered in doses of twenty minims, with the addition of some narcotic, if the cough be very troublesome. It is in such cases, when the cough is too frequent and inefficient to produce expectoration, or when the sputa are thin and irritating, that the sedative expectorants become necessary. The best vehicle for administering these expectorants is the bitter-almond emulsion, which aids greatly in soothing the irritability of the secreting membrane. It is sometimes of use, when the sputa are very viscid, to add liquor Potassæ; and, if tonics be indicated, there is no objection to combine them with the expectorants. It is under such circumstances that Tussilago, which combines both tonic and expectorant powers, has been found useful. In those cases in which Peripneumony supervenes on Hooping-cough and Influenza, after free depletion, if the bronchial tubes become charged with frothy mucus, and the strength fails, the decoction of Tussilago is the best vehicle for the administration of Ammonia. It is equally useful in chronic catarrh.

In cases of pneumonia, where a sudden suffocative effect has been produced, besides stimulating with Ammonia, we should also expose the patient to the free action of cold air, so as to bring down the constitution to that state which will enable him to support the limited degree of respiration; and even the abstraction of blood, if the powers of the habit have not been previously much lowered, will undoubtedly aid this purpose. It is only upon this principle that we can explain the extraordinary recoveries that have occasionally resulted from a full bleeding, followed up by the free administration of Ammonia, or its carbonate, as an Expectorant.

In *Acute Bronchitis*, unless a state of collapse is threatened, and the excitability of the system is greatly reduced, Expectorants are not indicated; but, in the chronic form of the disease, they are beneficial, not only in promoting the ejectment of the mucus, but in modifying the secretion, giving it consistence, and altogether rendering it more healthy. Ipecacuanha or Emetina is well adapted for this purpose. The latter has been

successfully employed in France, in doses of $\frac{1}{8}$ to $\frac{1}{4}$ of a grain. It produces expectoration without inducing nausea; and we can readily explain this, if it be admitted that expectorants taken into the circulation are determined to the lungs as emunctories. When Ipecacuanha in the entire state is administered, it is usual to combine it with Opium, in the form of Dover's powder, of which three to five grains produce expectorant effects, without either nausea or diaphoresis. The French physicians say that Ipecacuanha is less beneficial as an expectorant than Emetina, owing to some fatty acrid matter which the former contains; but this opinion is purely hypothetical: the latter has one advantage, however; it does not act on the idiosyncracy of some individuals, and cause asthmatic breathing, such as occasionally occurs from Ipecacuanha.

Squill is a useful Expectorant also in *Chronic Bronchitis*, when no sub-acute inflammation is present, or when the sputa have not assumed a purulent character. It is commonly combined with honey and vinegar, in the form of an oxymel; but both of these adjuncts merely add to its irritating properties, and, if any tendency to inflammation exists, it causes a teazing irritating cough, without producing expectoration. It is more beneficial when combined with an alkali, or soap, and Ammoniacum. The dose of the dried Squill should not exceed one grain, as larger doses are apt to prove emetic. In its administration, the surface should be kept moderately warm, to prevent its determination to the kidneys. In some individuals, Squill produces a poisonous effect, causing vomiting, purging, and an eruption on the skin, even when administered in small doses. The best antidotes are Ammonia and the alkalies; and, indeed, in all cases when we desire to have the full influence of Squill, alkalies are improper as adjuncts to it.

In *Coughs, with dyspnœa*, when the disease assumes a chronic form, the slightly stimulant Expectorants are indicated; such, for example, as Ammoniacum, and the balsams. The former is seldom given alone, but generally in conjunction with Squill or Antimonials. In the form of the Milk, Lac Ammoniaci, it may may be combined with Carbonate of Ammonia; and in this form it is superior to all other Expectorants in a peculiar irritable cough which often accompanies hysterical affections, or is coexistent with dyspepsia and hypochondriasis. The expectoration becomes freer and more abundant, the embarrassment and oppression of the lungs are diminished, and the patient is rendered altogether more comfortable. Ammoniacum is a very ancient Expectorant; it was employed by Crito, and formed the chief ingredient in the Pilulæ Balsamæ of Morton, which at one time had a high reputation in tubercular consumption; but the experience of the moderns have not upheld its ancient reputation. The dose is from gr. viii to gr. xii, three or

four times a day. In America, it has been conjoined with Nitric Acid, by triturating ʒii with fʒii of Nitric Acid, and then forming it into an emulsion with f℥viii of distilled water.

In *Asthma,* every form of Expectorant has been tried, and each has had its eugolists: but as they have often been prescribed on false theoretical reasoning, it is not wonderful that disappointment has too often been the result of the employment of many of them. In some cases of the disease there is no accumulation of mucus in the air passages: there is, however, a most important class of cases in which the augmentation of the bronchial secretion would prove salutary: and hence some of the stimulant expectorants have been found useful. This occurs when the disease is complicated with dry catarrh, in which the mucous membrane is in a low degree of irritation, and the secretion is thick, gelatinous, and extremely adhesive, and consequently adds greatly to the difficulty of breathing. It was to relieve this state of the bronchial system that the attenuants were prescribed by the old physicians.

Although, in the greater number of cases of Asthma, Expectorants are of no use, there being little or no excessive secretion or exhalation in the air passages, the disease consisting chiefly of a morbid constriction of the bronchial muscles, yet in that form of *catarrhal Asthma,* which is usually termed *humoral Asthma,* they are more or less indicated. This is often the result of repeated attacks of Catarrh, or a sequel of Bronchitis; the asthmatic paroxysm supervening to this state. Now, in both these varieties of Catarrhal Asthma, Expectorants have proved beneficial. In dry Catarrhal Asthma, the pure alkalies were in former times ordered as attenuants, to thin the thick viscid mucus adhering to the sides of the bronchial tubes: and although the humoral theory is at an end, yet in Italy the alkalies have been again successfully resorted to for augmenting the secretion of the mucous membrane, and enabling the viscid mucus to be detached and expectorated. They were introduced about the end of the last century by Mascagni, upon the exploded principle of their attenuating powers; and the Italian physicians have followed him, in this respect, with great success. They inform us that the alkalies augment the secretion and lessen its tenacity; and these views of their influence, and the results of their administration, have been confirmed in this country by those who have adopted them. In humoral asthma, as it is termed, the stimulant Expectorants, which possess antispasmodic properties, such as Assafœtida and Galbanum, have been found most beneficial. They may be combined either with Ipecacuanha or with Squill, according to circumstances.

In *tubercular Consumption,* Expectorants, both topical and general, have always been more or less employed: but the opera-

tion of the general Expectorants, if our view of the subject be correct, is not that which would be likely to benefit in this intractable form of disease. Ipecacuanha is frequently prescribed in the early stages; nevertheless, I am of opinion that any benefit derived from it is to be attributed rather to its tonic influence, operating favourably in allaying the general irritability of the habit at this period of the disease, than to any expectorant power which it may possess; and this is rendered more probable by the fact, that, in modifying the secretion, it rather diminishes than increases the expectoration. It is usually prescribed in doses of a grain, combined with three or four grains of extract of Conium or of Poppies, three or four times a day. I have generally prescribed it in the form of Dover's powder, in the emulsion of bitter almonds, which greatly aids its soothing influence.

It is in Phthisis that topical Expectorants have been chiefly employed. The first of these which I shall notice is the vapour of boiling Tar, which was introduced to the notice of the profession by Sir Alexander Crichton, who had seen it employed in Russia, with much apparent benefit to the patients, if not with success in curing the disease; and I believe this is all that can be said in its favour, from the trials made of it in this country. Its mode of operating is easily understood: it applies a moderate stimulus to the ulcerated tubercles, and, improving the discharge, favours cicatrization exactly on the same principle that stimulant applications operate in external ulceration. It produces in general an increase of the cough; but this soon abates; after which the expectorated matter is, in most cases, much improved. These effects promised the most favourable results from the extended use of the vapour of Tar; but the expectations of practitioners were disappointed, and the remedy is now rarely, if ever, employed. Whether this neglect be well merited, or be the result of too high anticipations of its powers having been entertained, I will not venture to determine.

On the same principle, the use of the vapour of burning *undressed* Wool was recommended to the profession by Dr. Physick, an American physician. He had found it extremely serviceable in cicatrizing obstinate external sores, and concluded that it might prove equally so if exhaled in an ulcerated state of the lungs. Like the vapour of boiling tar, it excites great coughing; but this rapidly subsides, and some degree of comfort is experienced by the patient: but here, I believe, every benefit expected from the vapour of undressed wool terminates. I have tried it in a few cases; but the result of these does not authorize me to speak favourably of its employment as a remedy in Phthisis.

The only vapour which seems to promise any beneficial

result in Phthisis is Chlorine; but whether we can rank it, on this account, among topical Expectorants, is questionable. When largely diluted with atmospheric air, it is undoubtedly capable of promoting both a more healthy secretion of the mucous membrane, and also aiding the ejectment of the mucus from the air passages: but it is not in this manner that it operates beneficially in phthisis. If breathed, or rather attempted to be breathed, in an undiluted state, it does not enter the bronchial tubes, but causes a violent spasm of the glottis; and if this be not immediately relieved, suffocation may ensue. When moderately diluted with atmospherical air, it enters the lungs, and excites violent coughing, great irritation in the bronchial cells, dyspnœa, and a painful, anxious sensation in the chest, which continues for several days. When still more diluted, namely, with several hundred parts of common air, and inhaled, it operates as a salutary stimulus to the mucous membrane, sets up a new action in the ulcerated and diseased portions of the lungs, which, could it be easily maintained for a sufficient length of time, at the same moment supporting by other means the tone of the system without general excitement, seems to promise much benefit in this hitherto intractable disease.

Chlorine gas, largely diluted, was first proposed as a topical remedy by Dr. Favart, of Marseilles, in 1804. Soon after that period, I had an opportunity of witnessing its beneficial influence as an expectorant and salutary stimulus to the lungs, in a severe case of epidemic catarrh, in which the powers of the system were greatly reduced. The beneficial influence which it exerted in that case induced me to try it afterwards, occasionally, both in some varieties of asthma and also in phthisis; but as no permanent cure in the latter affection had followed the employment of it, no publication was made of its effects. Chlorine, therefore, as a remedy in phthisis, was not brought before the profession until after a report had been made on the subject by Dr. Cotterau, of the faculty of medicine of Paris, several years afterwards. Its influence in pulmonary diseases had, indeed, been observed by individuals employed in manufacturing it for the purposes of bleaching, both on the Continent and in this country. Mr. Tennant, of Glasgow, one of the largest manufacturers of bleaching materials, containing chlorine as their active ingredient, had observed that men engaging themselves to work in his manufactory, who had coughs, were rapidly relieved when they were gradually introduced into the chlorine house; and, from a knowledge of this fact, people labouring under phthisis and asthma frequently take lodging in the neighbourhood of his works, within the influence of the chlorine, and derive much benefit from their residence there. The same beneficial effects had been observed in the works of M. Gannal, a manufacturer of bleaching liquid in Paris; and the mention of this fact by M.

Gannel to Dr. Cotterau laid the foundation for its employment on the Continent.

When therapeutically employed, about f℥ii to f℥iv of a saturated aqueous solution of the gas is introduced into a glass inhaler, with from three to four ounces of hot water, which slowly drives off the gas; and thus it is gradually received into the lungs, in combination with warm aqueous vapour, and largely diluted with common air. When thus inhaled, the obvious effects are a slight sensation of constriction of the thorax; some augmentation of the cough; occasionally a trifling degree of vertigo; and expectoration with little or no effort. In a short time after each inhalation, which is generally repeated every fourth or fifth hour, the patient gradually feels more comfortable in every respect than before inhaling the gas. In some cases, in which I have ordered this gas to be extricated in the usual way for fumigations in the rooms of phthisical patients, introducing into the apartment basins of boiling water to afford a humid atmosphere, I have observed a decided abatement of the hectic symptoms, a great alleviation of the cough, and an increase of strength, in the diseased: but I cannot venture to assert that, even when the influence of the chlorine was thus kept up for a considerable time, I have seen any case of phthisis cured. In the advanced stages of the disease, when large vomicæ exist, a fatal result is what might be expected; and it may be thought visionary to anticipate a cure from any means in such cases: but, if we reflect on the influence of chlorine in improving the discharge from diseased mucous surfaces, as, for example, that of the nostrils which amounts to coryza in malignant scarlatina, and in promoting the cure of external ulceration, it is not a vain speculation to expect much advantage from its inhalation in phthisis.

From my own experience, I can say little in favour of the inhalation of Iodine as an Expectorant; in two cases only I have employed it, and in both it seemed to hurry on the fatal termination. I have, therefore, not even mentioned it as one of the topical Expectorants.

In all inflammatory affections of the chest, the inhalation of warm water, and the administration of nauseating doses of Ipecacuanha, or of Tartar Emetic, with or without Opium, are the most efficacious mode of promoting Expectoration. In some instances, full vomiting has proved beneficial; and although this may appear at variance with the existence of the least trace of inflammatory action, yet, by favouring a transfer of action, it augments the secretion of the mucus from the pulmonary exhalants, producing the most marked relief. The vomiting should be full, and kept up for at least an hour. If, notwithstanding the employment of these means, the Expectoration becomes too abundant, and it tends to clog up the bronchial cells, then the

stimulating Expectorants, namely, Squill, Ammoniacum, the Balsams, Ammonia, and the stimulant gases, are indicated.

After bleeding, if it be indicated, and the exhibition of an emetic, the best results have followed the administration of small doses of the compound powder of Ipecacuanha. When the inflammatory and febrile symptoms have been subdued, and cough, attended with a thin frothy excretion, remains, then the Gum Resins, the Balsams, and Opium, administered in the evening, and at bed time, are generally productive of the most beneficial results. But, in every disease of the lungs, expectoration may be too profuse; in which case we must maintain the vigour of the system by tonics, and other means likely to produce strength: stimulating Expectorants must not be prescribed, nor any substance which can irritate the mucous membrane: tone, not stimulus, is demanded.

In the low stage of pneumonic inflammation, when the fever has assumed a typhoid character, and the lungs are loaded with mucus, the inhalation of the irritant gases, the internal administration of the Balsams, and that of the Carbonate of Ammonia, are essentially beneficial.

In concluding these remarks on this class of Medicines, it is proper to mention, that, in prescribing Expectorants, three general rules should be kept in view:

1. The surface of the body should be kept moderately warm, in a gentle breathing perspiration.
2. Whatever determines to the kidneys should be avoided.
3. Purging should be carefully guarded against; for, as the action of the secreting vessels of the lungs, and those of the intestines, seem tó be opposed to one another, Expectoration is checked when purging occurs.

SECTION XV.

CATHARTICS—MEDICAMENTA CATHARTICA*.

Syn.—Purgatives.

The term Cathartic may be applied to any medicinal agent which accelerates the peristaltic movements of the intestinal canal, promoting secretion from its mucous surface, and aiding the evacuation of its contents. When any such substance is taken into the stomach, it sometimes excites a slight degree of nausea, which, after a short time, is followed by an uneasy

* From the Greek verb, καθαιρω, I cleanse or purge.

sensation in the abdomen, accompanied by a rumbling sound, and a fulness in the lower bowels: slight rigors are occasionally felt; and, just before the dejections take place, the pulse fills, and the skin feels hot and dry. It is not, however, always requisite that the substance should be taken into the stomach; the same effects result if it be introduced into the rectum; or, in some instances, even if it be applied to the skin. A Cathartic, therefore, operates both by a local and a sympathetic impression on the intestinal canal: it excites purging; but its influence is not confined to the alimentary canal; it is extended to the neighbouring viscera, and, in many instances, to the whole system.

In order to understand correctly the manner in which Cathartics operate, we ought to have an accurate idea of the organization and natural functions of the parts on which their nfluence is exerted.

The alimentary canal, independent of the stomach, includes the small and the large intestines, comprehending the *duodenum*, into which the biliary and pancreatic ducts open; the *jejunum*; the *illium*; the *cæcum*, which is a kind of second stomach; the *colon*, and the *rectum*. The whole canal is lined with a mucous membrane, which forms, in some parts, undulated plaits, or *valvulæ conniventes*, that greatly augment the extent of its surface. This membrane, in the small intestines, is studded with follicles so minute as to be invisible to the unaided eye; but when examined with a good glass, the membrane appears like a sieve. In the large intestines, these follicles are less numerous, but of greater size. They are intended for secreting a viscid mucus which lubricates the surface of the canal, and which is greatly increased by the action of Cathartics. There are other follicles visible to the naked eye, in the duodenum and upper part of the small intestines, named, from their discoverer, *Brunner glands*; and lower down are patches of larger glands, named *agminatæ*, or *glands of Peyer*, consisting of sacculi, surrounded with openings like those of the mucous follicles. Under this mucous membrane is a muscular coat, consisting of circular and longitudinal fibres: and covering this is the *serous* coat, reflected from the parietes of the abdomen. The whole is well supplied with blood-vessels and nerves, the arteries are seeondary vessels from the aorta; the nerves are derived from the superior and inferior mesenterie plexus, and connected with the great sympathetie: hence the intestines communicate, sympathetieally, both with the brain and the spinal eord. The action of the museular eoat is involuntary, and dependent on the sympathetie nerve: but at the termination of the canal, or anus, the museles are dependent on the eerebro-spinal nerves and the will. Our knowledge of this nervous conneetion between the intestinal canal and the rest of the system enables us to explain the general effects of Ca-

thartics. With respect to the functions of this canal, when the chyme passes out of the stomach into the duodenum, it is there mixed with the bile and pancreatic juice, and moved into the jejunum, through which it passes slowly downwards; whilst the chyle, being separated from the fæces, adheres to the villi, and is absorbed and carried into the circulation. This progress and absorption are continued through the whole remaining length of the smaller bowels, until the now nearly completely digested mass, mixed with the natural mucus of the passage, is pushed forward into the cœcum, where it is supposed to undergo a kind of second digestion*, after which, being received into the colon, the cells of this intestine give lodgment to the fæces, retain them, and prevent their too rapid descent into the rectum. In these cells, when the great intestines are torpid, scybala or hard fæcal balls are formed, by the fæces remaining too long in them; and it is only by the pouring out of the secretions of the intestine, when it is stimulated to increased action, that these are loosened or dissolved, and ejected from the body. But, besides the fæces and the secretions, a large quantity of gas, consisting chiefly of carbonic acid gas, carburetted hydrogen, sulphuretted hydrogen, and nitrogen, is always present in the canal.

The intestines perform two distinct movements — a *vermicular* and a *peristaltic*. Upon looking into the abdomen of an animal suddenly killed by a blow on the occiput, or by hydrocyanic acid, and opened, we perceive at first a very faint, but after a short time, an obvious movement in the intestines, a drawing-in of one part, and an inflation and elongation of another, resembling, in some degree, that motion which proceeds from a snake or long worm coiled up: this is the *vermicular* motion. But, besides this movement, there is a direct contraction of the diameter of the gut, by the action of the circular fibres, occurring in a regular series, from above downwards, through the whole length of the canal; each successive portion contracting before the former is completely relaxed: this is the *peristaltic* motion. By the joint action of both, the food is passed along the canal, and ejected from the body. It has been supposed that, when any cause obstructs the progression downwards of the contents of the bowels, or the successive series of constrictions of the circular fibres are interrupted by any means, the natural action is then inverted, and an *antiperistaltic* movement takes place. Even in the natural or ordinary action of the intestines, the food is partly carried in some measure backwards as well as forwards; but, nevertheless, the natural action is downwards.

The intestines are stimulated to action by matters within the canal, chiefly of a chemical nature: the immediate impression of which upon the mucous membrane is communicated to the

* Tiedemann and Gmelin.

muscular coat, and causes it to contract, by which the contents of the gut are pushed forward to stimulate another portion, whilst the former relaxes; hence, by such alternate contractions and relaxations, the ingesta traverse the whole of the canal with more or less rapidity, according to the degree of the stimulus that excites these movements. Substances, therefore, which excite an increase of the natural action, are regarded as *Cathartics;* and during their operation, if the accordance which exists between the contractions of the longitudinal and circular fibres be disturbed, colic pains result, which are more or less severe according to the energy of the Cathartic. When the stimulus is moderate—as, for instance, when it arises from the natural contents of the bowels—the villi, each of which is accompanied with an artery and a vein, a lacteal or an absorbing vessel, and a nerve, are erected and absorb the chyle; if it be in a small degree augmented, the interior coat pours out a greater quantity than usual of its natural secretion, or *liquor entericus,* a watery fluid resembling the gastric juice, and mucus secreted by the follicles on the interior surface of the canal; if the stimulus be still greater, the peristaltic motion of the bowels is accelerated, and their contents are hurried forward; whilst, at the same time, there is a still more augmented excretion both of the *liquor entericus* and the mucus. Like every other organ, however, the intestines are stimulated, in the manner that has been described, within a certain limit only: beyond this point, inflammation is the consequence, and the results are altogether different. Substances that stimulate the intestines only within the limits alluded to can be regarded as *Cathartics.*

Cathartics act *locally* on the intestines, stimulating, with more or less energy, one or other of the divisions of the canal above enumerated; but, whenever their first impression is made, their influence extends to the neighbouring viscera; sometimes to the whole system. When their action is confined to the intestinal canal, they prove beneficial, by restoring its suspended function. The first stools that occur after a purgative has been taken are similar to those caused by the natural movement of the bowels; they are the contents of the colon and the rectum; the next are chiefly fluids, resulting from the irritation of the mucous follicles and the exhalants of the intestinal tube, mixed with bile, pancreatic juice, and the drink taken to aid the action of the Cathartic. But, besides their topical operation, Cathartics influence the stomach, hurrying its contents into the duodenum: and they promote and increase the flow of bile and of the pancreatic fluid, by stimulating the excretory ducts of the pancreas and liver: for the stimulus applied to the excretory ducts of these organs is communicated to the organs themselves; hence a great quantity of blood is determined to them, and an increased secretion is the consequence. The knowledge of this

fact enables us to account for a result of frequent purging which is too little attended to: the secretions, instead of being improved, are deteriorated, owing to the constant irritation communicated through the excretory ducts, hurrying the natural function of the liver, and thereby rendering the secretion imperfect, if not vitiated. I know a lady of rank who has too little to occupy and fill up her time; and therefore is so susceptible of every corporeal feeling as to imagine that she always requires the aid of purgative medicines, and actually takes a dessert spoonful of castor oil every morning. The consequence is, that the egesta never present a healthy appearance; and indeed they always appear as if she were suffering under what is termed a bilious attack. Cathartics also influence the kidneys, the secretion of which is generally diminished by their continued use, as the fluids which they cause to be discharged by the intestinal exhalants would have been excreted by the kidneys. Their influence upon the uterus is more decisive, owing to the contiguity of that organ to the rectum rendering it susceptible, especially in a diseased state, of the influence of stimulants affecting the rectum; hence some Cathartics, which are supposed to act specially upon the rectum, are regarded as Emmenagogues. But the influence of Cathartics is not confined to the abdominal viscera; it extends to the whole system: and were this not the case, this class of medicines would be of very limited value as therapeutical agents; their evacuation of the intestinal canal is a small part only of the benefit which results in disease from their employment.

Cathartics differ with respect to the part of the intestinal canal upon which they act: some, as, for instance, calomel and rhubarb, particularly stimulate the duodenum, and thus promote the discharge of the contents of the biliary ducts; others, as aloes, exert their influence on the colon and rectum; whilst the saline and oleaginous purgatives increase the peristaltic motion of the whole intestinal tube. No satisfactory explanation of the cause of this difference of action has yet been advanced; but the knowledge of the fact is of great importance in a practical point of view.

Cathartics are said to act generally, when, besides the evacuation of the bowels, they cause a copious discharge of serous fluid from the circulating mass; the suddenness of which, combined with the quantity discharged from the intestinal exhalants, produces a powerfully sedative effect upon the whole frame; the force and velocity of the pulse are diminished, and febrile and inflammatory action greatly lessened. In some instances, indeed, as when *Elaterium* is administered, the discharge of watery fluid is so excessive, that alarming and even fatal effects have resulted. If the purging be long continued, the chyle is evacuated; and hence, in protracted diarrhœa, the blood loses its red colour, the

surface of the body becomes pallid, and symptoms of exhaustion supervene. They are also supposed to excite the general action of the absorbents; and on this principle is explained the removal of extravasated fluids: even solid matters, the productions of disease, are fequently removed by active purging; an effect attributable to a law of the system, by which a great discharge of serum is followed by an *apparently* increased action of the absorbents. I use the term *apparently*; for it is problematical whether the absorbents be excited, or the common capillaries stimulated so as to carry on their contents without exhaling serum. In either case the effect is the same.

Although the primary influence of Cathartics, that of exciting the alimentary canal, is shared by all of them, yet they differ considerably in their secondary effects. Some operate quickly, others slowly; some produce nausea, griping, and tenesmus; others operate with less sensible impression; some cause one copious evacuation only; others repeated stools. The dose, also, in which Cathartics are administered, greatly modify their action. Some, when given in large doses, only slightly augment the peristaltic movement of the bowels: others, when given in minute doses, produce numerous watery stools, with pain and great irritation; some act so violently as occasionally to excite inflammation. Cathartics have been accordingly divided into *Laxatives*, simple *Purgatives*, and *Drastic Cathartics*. But, besides these divisions, the frequent necessity of administering Cathartics by the rectum renders a fourth division requisite; namely, *Enemata*.

But some Cathartics also cause purging when they are only applied to the skin. Thus, if a cataplasm of Rhubarb be laid upon the pit of the stomach of a child, the bowels will be emptied; and if Aloes be applied to any abraded surface, the same purgative effect is produced upon the rectum as if the medicine had been taken into the stomach. This method, however, of exhibiting Cathartics, is rarely or never employed, although it might be advantageous under certain circumstances; when the patient, for example, obstinately refuses to take medicines by the mouth, and when more harm than benefit would follow the employment of force. On the same principle, placing one or two drops of Croton oil on the tongue purges briskly, when the powers of deglutition are suspended, and enemas do not fulfil the intention of the practitioners.

Before describing each of the divisions above enumerated, it is proper to make a few remarks upon the nature of the matters evacuated. They vary considerably in *colour*; they are either brick-red, brown, yellow, greenish, slate-coloured, clay-coloured, black, or nearly white; in *consistence*, firm or scybalous, soft, pultaceous, or watery; and with respect to *odour*, more or less fœtid. They may be also mucaginous or puriform: the former

depending on the excitement of the secretory action of the crypts of the mucous membrane; the latter on ulcerations of that membrane. According to the character which the discharges presented, the ancients classed purgatives under the heads *hydragogues*, *phlegmagogues*, *chologogues*, and *panchymagogues*. If watery stools were produced by the excitement of the intestinal exhalants, the cathartic which caused it was regarded as a *hydragogue**: if the stools were glairy, owing to the excitement of the mucous follicles, it was a *phlegmagogue*†; if they were much mingled with the secretion of the hepatic organ, a *chologogue*‡; and, finally, a *panchymagogue*§, when the evacuations were mixed nearly equally with the humours of the intestinal canal. But it was an error to ascribe these effects to the substances employed; the same cathartic will produce bilious stools in one person, mucous or serous in another: and, even in the same person, at different times, or under different circumstances, it will produce distinctly opposite effects. Nevertheless, as I have already stated, some cathartics act upon one portion of the intestinal canal, others upon another portion; and effects result, connected with the secretions of the part acted upon, which greatly modify the character of the evacuations. This truth was well known to the ancients, who ascribed almost all diseases to some peccant humor which required to be expelled; and they believed that purgatives could effect this expulsion. The cathartic was therefore selected which was best fitted to expel the particular humor on which the disease was supposed to depend. If, after employing it for a proper length of time, the disease still continued, it was then concluded that something else remained to be thrown out, and a new course of purgatives was resorted to.

Let us now examine the characters of each of the divisions of Cathartics.

1. *Laxatives* are *partially digestible* substances, and a few salts which gently stimulate the intestinal tube and moderately quicken its peristaltic action. They merely remove irritating matters from the bowels, and thereby diminish what has been termed the tension of the system, and abate the disposition to febrile action: they are on this account employed in cases in which active purging is unnecessary, and when the evacuation must be effected with the least possible irritation. A state of the bowels requiring such aid frequently occurs, independent of disease. Thus, in the ordinary healthful condition of the habit, the accumulation of the fæces in the rectum generally happens daily at the same hour, and a sensation is excited which indicates the necessity of evacuating the bowels; but if this period be

* From ὕδωρ, water, and ἄγω, I eject.

† From φλεγμα, phlegm, and ἄγω.

‡ From χολή bile, and ἄγω.

§ From παν, all, χυμος, juice.

permitted to pass over, the contents of the rectum are again partly thrown back upon the colon: the habit of evacuating them at a certain time having been interrupted, a torpor of the great intestines follows, and some additional stimulus, such as that afforded by a laxative, is required to re-excite their ordinary action. In children, and also in individuals of delicate habits of body, the debility which, more or less, always follows the use of the more active Cathartics, would often prove highly detrimental, and therefore Laxatives are employed. Some of these owe their effects to a mechanical property; as, for example, bread made of flour which has not been bolted or freed from the bran, proves laxative, owing to the spiculæ of the horny testa of the grain which have been left in the flour. These pass the pylorus unaltered, and stimulate mechanically the alimentary canal. Many laxatives, also, owe their influence to their chemical properties; this is the case with almost all vegetable substances containing the saccharine principle, such as sugar, manna, honey, the juices of ripe, particularly subacid, fruits, malted grain, fermented liquors, bland fixed oils, sulphur, and magnesia. Laxatives owe little of their purgative powers to quantity.

2. *Simple Purgatives* are *indigestible* substances, which, taken into the stomach or introduced into the rectum, augment their peristaltic movement. The action of simple purgatives is, therefore, merely an increased degree of that of laxatives; but, besides augmenting the peristaltic action of the intestinal canal, they stimulate their secreting surfaces, so that a larger quantity of fluids than is usual is excreted by the intestinal exhalants. Simple Purgatives may be subdivided into—1. *Cooling Purgatives*—those, for instance, of a saline nature, which stimulate moderately the exhalants, without causing any febrile excitement in the habit. 2. *Mild acrid Purgatives* which stimulate more than the former, but the action of which does not approximate to inflammation.

The necessity of employing *Simple Purgatives* is founded on the same circumstances as those which demand the use of laxatives; but as their operation also reduces the powers of the system, they are indicated in diseases of excitement; in which the mere evacuation of the alimentary canal of its contents is a secondary consideration. In continued torpor of the bowels, giving rise to an accumulation of fæces in the larger intestines, more active stimulants of a cathartic nature than simple laxatives are requisite; hence, in such cases, simple saline or acrid Purgatives are employed. But, as I have already said, the most important application of Purgatives is not to obtain their operation on the intestines themselves, but the influence which they exert upon the other parts of the system. In this respect they form a portion of what has been termed the antiphlogistic plan of treatment,

that-which is chiefly applicable to inflammatory diseases. By diminishing arterial action, they promote absorption: it is this effect which renders their frequent use productive of wasting of the body: they accelerate the pulse before they operate; they develop animal heat, cause thirst, diminish perspiration, and, after their operation, induce sleep.

3. *Drastic Cathartics* are also indigestible substances, which operate in the same manner as simple purgatives, but with much greater energy, and affect the nerves of sensation more than simple Purgatives, frequently causing griping or tormina, nausea and vomiting. This influence, however, on the nerves of sensation is not essential to the fulfilment of the intention with which Drastic Cathartics are administered. In large doses, they operate as acrid poisons, causing inflammation, sometimes ulceration of the mucous membrane. Drastic Cathartics are generally resinous, oleo-resinous, or resino-extractive substances.

Although Cathartics have been described as of three kinds, yet, it is impossible to mark the limits where one kind terminates and the other commences; for all, with a few exceptions, may be arranged under one head; the difference depending rather on the energy of their action than on any specific or peculiar mode of operation. The effects, indeed, of Cathartics depend on such a variety of circumstances, that even laxatives may operate in some cases with violence, and a mild and scarcely sensible action may follow the administration of the most drastic Cathartics. A question here presents itself, namely, are Cathartics absorbed? We know that the colouring matter of Rhubarb, Gamboge, and some other purgatives, can be detected both in the urine and in the cutaneous perspiration; we know, also, that an infant at the breast of a nurse who has taken a dose of Senna, or Rhubarb, or Jalap, is purged; the flesh of birds who feed on the berry of the Rhamnus *catharticus* has a purgative property; and some cathartic substances, such as Sulphate of Potassa, oil of Turpentine, Gamboge, and Rhubarb, have been detected in the blood contained in the venæ portæ, the inferior cava, and the right ventricle of the heart*. The fact of absorption, therefore, must be admitted; but, at the same time, it is undoubted that Cathartics operate independent of absorption. Many purgatives excite purging when they are injected into the veins; and I have already mentioned some which operate when they are applied to ulcerated surfaces. Some purgatives, however, cease to operate as such when they are absorbed. Thus, Sulphate of Magnesia, when largely diluted, is absorbed, and, instead of purging, operates on the kidneys.

Let us now enquire what are the circumstances which modify the operation of this class of medicines.

1. *Quantity* modifies the operation of Cathartics; and this

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* Tiedemann and Gmelin.

is so obvious as scarcely to require any comment. The rule, however, is not general: some drastic purgatives—for instance, Elaterium and Croton oil—exert their full effects in such minute doses, that it is impossible to reduce their action to that of a simple purgative. On the other hand, some laxatives—for example, Sugar, Manna, Magnesia—cannot in any dose be brought to operate as drastic Cathartics. Within a certain range, however, *quantity* has a considerable influence.

2. *Mechanical division* has a considerable power in modifying the action of Cathartics. The resinous Cathartics, when coarsely powdered, cause griping and even tenesmus; while in a state of more subtle division, they operate with less sensible effect—a circumstance at variance with the law which regulates the action of most other substances. No satisfactory explanation of the influence of division in modifying the action of Cathartics has yet been attempted. Were I to hazard an opinion, I should say that it depends upon some change effected in the substance, when so great a surface is exposed to the action of the air as necessarily must be the case when resinous substances are reduced to impalpable powders. Whether any thing like oxidizement occur, future experiments must decide. The opinion, however, is not improbable, when we observe the great change which even light produces upon impalpable powders. If a powder—for instance, rhubarb—be preserved in a glass bottle, the side always exposed to the light will be changed in colour, rendered nearly white, and prove less active, while that which is shaded from it remains unchanged, both in colour and medicinal property.

3. *Combination* is a third modifying cause. If Camphor be combined with Senna or Colocynth, the purgative properties of these substances are augmented; but at the same time their influence on the sentient nerves is greatly diminished. By such a combination, the Colocynth is rendered more soluble; but in the case of the Senna, the activity of which is augmented when the Camphor is added to the decoction, some other explanation must be sought for.

Other *Excitants*, besides Camphor, augment the energy of purgatives, by elevating, as it were, the vitality of the torpid bowels; the purgative substance makes a more powerful impression in the ratio of the increased susceptibility to impression of the mucous membrane. The cathartic action is more rapid and more forcible, while, at the same time, nausea and gripings are abated. *Emollients*, on the other hand, diminish the influence of Cathartics; and the same is the effect of acidulated fluids. *Narcotics*, under ordinary circumstances, weaken or retard the operation of purgatives; but, in cases of spasm affecting the intestinal tube, the addition of an opiate, by allaying this, tends to augment the powers of the purgative. Sydenham frequently

combined opiates with Cathartics, and found that the narcotic, by resolving spasm, aided greatly the peristaltic movement of the intestinal canal.

Cathartics differ as to the time necessary for producing their effect: some operate in two or three hours, others require from eight to twelve hours. These differences are supposed to depend in a great degree on the solubility of the substance in the gastric juice and fluids of the alimentary canal. The time required is said to be exactly in the inverse ratio of the solubility of the purgative; from which circumstance, the saline purgatives operate in the shortest time, and the resinous, from their little solubility, require the longest time. It is probable, also, that this difference of solubility enables them to act on different parts of the canal. If, for example, they are altered by the juices of the stomach, as in the case of Calomel, which acquires activity from meeting with hydrochloric acid in that viscus; or if they be very soluble in the juices of the duodenum, as in the case of Jalap, they will act immediately there: their action will not, however, be confined to that part, but will be extended through the whole canal, augmenting the excretion of the fluid secretions. The resinous Cathartics, on the contrary, being much less soluble in the animal juices, dissolve more slowly, and therefore operate upon the lower intestines. But, in admitting the plausibility of this explanation, truth obliges us also to admit that it is not satisfactory: Aloës, for example, if applied to an ulcerated part on the surface of the body, still exerts its purgative influence chiefly on the rectum; and Aloës is more soluble than jalap, which acts on the duodenum.

It is of importance, in a practical point of view, to be intimately acquainted with the *time* required for the operation of purgative medicines; as it enables us to adapt our remedies more decidedly in certain cases. The saline purgatives, owing to the rapidity of their action, as well as their influence in emptying the vessels of the system, are best adapted for acute diseases, especially those of a febrile and inflammatory character; while the resinous purgatives of an opposite character are better calculated for chronic affections.

Cathartics differ considerably in their ultimate effects upon the system. In general, they induce a subsequent costiveness, which is supposed to depend on the evacuation of the fluids of the intestines being so considerable that some time is requisite to replace them; but it is more probable that it is the result of that law of the constitution, which determines that almost every increased action must be necessarily followed by a state of inactivity or collapse. The more active and general, also, the action of a purgative, the more likely is costiveness to follow. The saline purgatives, owing to their operation on the whole intestinal canal, often leave more sluggishness of the bowels than

existed before their employment. Rhubarb has the same effect; but, on the contrary, as an exception to this rule, Aloës, and Castor oil, which operates on the whole length of the intestinal canal, tend to produce the opposite effect; and the same property belongs to Croton oil. By this continued use, they gain energy; and, after some time, the *smallest* dose will operate as effectually as the *largest* did at first. Those resinous Cathartics which operate on the lower intestines often leave the bowels in what is termed a more soluble state, that is, more open than before.

In the administration of Cathartics, some attention is required to the following circumstances.

1. Cathartics are generally more necessary and serviceable in warm than in cold climates, owing not only to the greater vitiation of the contents of the intestines and the augmented secretion of bile in high than in low temperatures, but, also, to the great determination of fluids to the skin in warm climates favouring the formation of scybala. As to the influence of season, it is an old maxim that purgatives should be given in spring and in autumn, or, as the term is, in the *decline* and *fall;* and it is true that more inflammatory diseases prevail at these seasons than at other periods of the year; but the custom should not be followed by persons in health, as it might induce a habit which would prove hurtful.

2. The constitution of the patient must be attended to. In general, Cathartics are more required by persons of a melancholic than those of a sanguine temperament, the bowels being generally more torpid in the former than in the latter. There are, however, exceptions to this rule: women, although they are more commonly of the sanguine temperament, yet are more generally disposed to costiveness than men; they do not, however, bear the operation of Cathartics so well as men. In pregnancy, and during menstruation, no drastic Cathartic should be administered: for it is well known that medicines which cause abortion do so by their cathartic influence on the rectum; nor should cathartics be freely administered in conditions of debility. Where any idiosyncracy exists, connected with the operation of Cathartics, it should not be disregarded; as much injury may follow the employment of certain kinds of purgatives in such instances: thus, in some individuals, a dose of Rhubarb will cause convulsions, closely resembling those of epilepsy; in others, the smallest dose of Calomel will produce alarming Syncope. The readiness with which ptyalism is induced in some individuals by Calomel is also a circumstance which requires consideration.

3. Although a costive habit should be strictly guarded against in childhood, yet we must keep in remembrance that children bear the action of Cathartics worse than adults. On account,

also, of the depressing effects of saline purgatives, those of a warm nature are best adapted for aged persons; but, in attending to this general rule, we must also recollect that debility may arise from very opposite states of the system, and also from very opposite causes; and by removing these, the strength is increased.

4. Cathartics ought not to be too frequently administered; as, by the excitement they produce on the mouths of the hepatic and pancreatic ducts, they cause a hasty, an irregular, and imperfect secretion of the bile and pancreatic juice, which is highly injurious to the digestive function.

5. As a general rule, Cathartics are inadmissible in inflammatory states of the alimentary canal which have gone on to ulceration, or where there is a tendency to dysenteric affections.

6. The nature of a Cathartic determines the period in which it should be administered. If it require a long time to operate, it should be given at *bed-time;* if it be of quick operation, in the *morning*, or at any time during *the day;* thus, saline purgatives, senna, castor oil, croton oil, and claterium, are best administered in the morning; the gum-resins, sulphur, and calomel, in the evening. But the action of Cathartics may be at any time quickened by copious dilution with warm aqueous fluids, taken about an hour after the cathartic has been swallowed. "Corpora, ubiquis purgare volucrit facile fluentia reddere oppertet." When spasm is present, the Cathartic may be combined with opium or some narcotic; for although opium may, in general, retard the operation of the Cathartic, yet, when spasm affects the intestinal canal, this addition secures and promotes, and even accelerates, its operation.

7. During the operation of Cathartics, cold applied to the surface must be avoided, as the body at this time is more liable to be affected by it; and the Cathartic may cause a diuretic instead of a purgative effect

8. During the operation of Cathartics, it is necessary to distinguish carefully the differences in the alvine discharges which are the result of disease, and those produced by the Cathartic. Calomel always causes the evacuations to appear unnatural; and, in order to ascertain their real aspect, the use of the medicine should be suspended for a few days. During the operation of Colchicum, the stools are of a bilious character; during that of saline purgatives, daily repeated, they assume a peculiar colour; and the effect of Elaterium is to produce stools resembling water in which meat has been partially boiled. The nature of these appearances and their distinctions shall be pointed out in treating of particular Cathartics.

TABLE OF CATHARTICS.

A. LAXATIVES.

* *Organic Products.*

Animal.

a.—Honey, prepared by			
Apis *mellifica.*	4.	12.	Hymenoptera.
Vegetable.			
b.—Acrid Bitter Matters, contained in Manna.			
Ornus *Europea.*	23.	2.	Oleaceæ.
* ——— *rotundifolia.*	—	-	———
* ——— *excelsior.*	—	-	———
* Tamarix *gallica.*	5.	3.	Tamaricaceæ.
* Eucalyptus *mannifera.*	-	-	Myrtaceæ.
in the Pulp of the Fruit of			
Cathartocarpus *fistula.*	10.	1.	Leguminosæ.
c.—Acidulous Fruits, of			
Tamarindus *Indica.*	10.	1.	Leguminosæ.
Prunus *domestica.*	12.	1.	Amygdaleæ.
d.—Fixed Oil, procured from			
Olea *Europæa.*	2.	1.	Oleaceæ.
Amygdalus *communis.*	12.	1.	Amygdaleæ.
Linum *Ussitatissimum.*	5.	5.	Linaceæ.

* * *Inorganic Substances.*

e.—Sulphur.

f.—Magnesia (*a hydrated oxide*).

g.—Salts.

Magnesiæ Carbonas.
——— Bicarbonas.
——— Acetas.

B. PURGATIVES.

* *Organic Products.*

a.—Fixed Acrid Oil, from			
Ricinus *communis.*	21.	9.	Euphorbiace
b.—Oleo-Resin, from			
Amyris *Gileadensis.*	8.	1.	Amyridaceæ.
Copaifera *Langsdorfii.*	10.	1.	Leguminosæ.
* ——— *bijuga.*	—	-	———
* ——— *multijuga.*	—	-	———
* ——— *Jacquini.*	—	-	———
* ——— *Guianensis.*	—	-	———
* ——— *coriacea.*	—	-	———

* Copaifera *nitida.*	10.	1.	Leguminosæ.
* —— *oblongifolia.*	—	–	——
* —— *Beyrichii.*	—	–	——
* —— *Martii.*	—	–	——
* —— *cordifolia.*	—	–	——
* —— *Sillowii.*	—	–	——
* —— *laxa.*	—	–	——
* —— *trapezifolia.*	—	–	——
* —— *Jussœui.*	—	–	——
* —— *officinalis.*	—	–	——
Abies *Larix.*	21.	6.	Coniferæ.
—— *Canadensis.*	—	–	——
Pinus *sylvestris.*	—	–	——
* —— *maritima.*	—	–	——
—— *Abies.*	—	–	——
* —— *palustris.*	—	–	——
* Abies *picea.*	—	–	——
* —— *excelsa.*	—	–	——
—— *balsamea.*	—	–	——
Pistacia *Terebinthus.*	22.	5.	Anacardiaceæ.
Linum *catharticum.*	5.	3.	Linaceæ.
c.—Resin, in combination with an unknown principle, in			
Ipomœa *Jalapa-(purga).*	5.	1.	Convolvulaceæ.
Rheum *palmatum.*	9.	3.	Polygonaceæ.
* —— *rhaponticum.*	–	–	——
—— *undulatum.*	–	–	——
* —— *compactum.*	–	–	——
* —— *Australe* vel *Enodi.*	–	–	——
* —— *hybridum.*	–	–	——
* —— *Webbianum.*	–	–	——
* —— *spiciforme.*	–	–	——
* —— *Moorcroftianum.*	–	–	——
* —— *crassinervium.*	–	–	——
* —— *leucorhizum.*	–	–	——
* —— *capsicum.*	–	–	——
Rumex *Aquaticus.*	6.	1.	——
—— *Obtusifolius.*	–	–	——
d.—Resino-Extractive, in			
Aloës *spicata.*	6.	1.	Liliaceæ.
—— *vulgaris.*	–	–	——
* —— *linguæformis.*	–	–	——
* —— *Commelini.*	–	–	——
—— *Socotrina.*	–	–	——
e.—Cathartin, in leaflets of			
Cassia *elongata.*	10.	1.	Leguminosæ.
—— *lanceolata.*	—	–	——
—— *acutifolia.*	—	–	——

Cassia *obovata.*	10.	1.	Leguminosæ.
—— *obtusata.*	—	-	————
* —— *Marylandica.*	—	-	————
* —— *corymbosa.*	—	-	————
* —— *biflora.*	—	-	————
* —— *tomentosa.*	—	-	————
* —— *Absus.*	—	-	————
* —— *alata.*	—	-	————

* * *Inorganic Substances.*

a.—Chlorides.
Sodii Chloridum.
Hydrargyri Chloridum (*Calomelas*).

b.—Metallic Oxides.
Pilulæ Hydrargyri.
Hydrargyrum cum Magnesia.

c.—Salts.
Magnesiæ Sulphas.
Sodæ Sulphas.
—— Phosphas.
—— Tartras.
—— Tartras et Potassæ.
Potassæ Sulphas.
——— Bisulphas.
——— Tartras.
——— Bitartras.
——— Acetas.

C. DRASTIC CATHARTICS.

* *Organic Products.*

a—Gum-Resins, procured from			
Cucumus *Colocynthis.*	21.	10.	Cucurbitaceæ.
* ——— *Hardwickii.*	—	—	————
Convolvulus *Scammonia.*	5.	1.	Convolvulaceæ.
Hebradendren *Gambogioides.*	23.	1.	Guttiferæ.
* Stalagmitis *ovalifolia.*	23.	1.	————
Rhamnus *Catharticus.*	5.	1.	Rhamnaceæ.
* Gratiola *officinale.*	2.	3.	————
b.—Oleo-Resin, in			
Helleborus *niger.*	13.	7.	Ranunculaceæ.
* ——— *orientalis.*	—	-	————
c.—Fixed Acrid Oil, from			
Croton *Tiglium.*	21.	8.	Euphorbiaceæ.
* ——— *Pavana.*	—	-	————

Euphorbia *lathyris.*	11.	3.	Euphorbiaceæ.
* Iatropha *Curcas.*	—	—	————
d.—NICOTINA, from			
Nicotiana *Tabacum.*	5.	1.	Solanaceæ.
e.—VERATRIA, from			
Veratrum *album.*	23.	1.	Melanthaceæ.
f.—COLCHICIA, from			
Colchicum *Autumnale.*	6.	3.	————
g.—ELATERIN, from			
Momordica *Elaterium.*	21.	10.	Cucurbitaceæ.
h.—UNKNOWN ACRID MATTER, in fruit of			
* Melothria *pendula.*	5	1.	Cucurbitaceæ.

*** Inorganic Substance.*

Antimonii Oxysulphuretum.

D. CLYSTERS.

ORGANIC VEGETABLE PRODUCTS WHICH OPERATE AS LAXATIVES.

** Organic Substances.*

Animal Productions.

a. HONEY. *Mel.* L. E. D.—Honey is produced by several species of bees, but most abundantly by the Apis *mellifica**, a well-known insect belonging to the order Hymenoptera. There are three descriptions of Bees, namely, females, males, and neuters, in every hive or community; the honey is collected solely by the neuters. It is gathered from the nectaries of flowers, sucked up by their proboscis, swallowed, and deposited in a peculiar receptacle within the body of the insect, whence it is again discharged into cells of the honey-comb; but whether it undergo any elaboration in the body of the bee, has not yet been accurately determined. It is probable that the change, if any, cannot be very great, as both the odour and the taste of honey is influenced by the nature of the flowers from which it is selected. Thus, when bees have been placed in fields of thyme, or lavender†, or rosemary‡, or any of the plants belonging to the natural

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* See the works of Huber, Dr. Bevan, and others.
† Lavender yields the Honey of Haute-Provence.
‡ Rosemary supplies the White Honey of Narbonne.

order *Labiatæ*, rich in volatile principles, the Honey preserves the odour of the flower, is of a high flavour, and of excellent quality; on the contrary, it is very bad when the bees feed on buck-wheat. The Honey of various parts of the world is consequently known by its peculiar flavour—that of Minorca differs from that of Narbonne; this from the Honey of England; and that of the southern parts of our island from the Heather Honey produced from the heath of the Scottish mountains. The finest Honey in the world is made on the Peak of Teneriffe: the bees feed on the Ratama, the white broom of the Canaries, the Spartium *nubigenum*. In some instances it is even imbued with poisonous properties from the flowers on which the bees have fed—a fact noticed by Xenophon in his account of the retreat of the ten thousand; and it is curious that Turnefort, when travelling in the same country, near Trebisonde, two thousand years after Xenophon, ascertained that the Greek soldiers were poisoned by the bees collecting the Honey, which produced that effect, from the flowers of the Rhododendron *ponticum* and Azalea *pontica*, beautiful plants which cover the mountainous district of Asia Minor. Poisonous Honey is also met with in various other parts, both in Asia and in South and North America. The Pollistes *lecheguana* make a poisonous Honey in Brazil; probably, says M. St. Hilaire, from the flowers of Pallinia *Australis**. Poisonous Honey is found in Maragnon and Paraguay, produced from unknown plants. Indeed, the wholesomeness of Honey depends altogether on the plants on which the bees feed; and many persons can eat one kind of Honey with impunity, but not another: thus, the Heather Honey of Scotland agrees well with many, who suffer severely if they even taste that of Narbonne. The effects of poisonous Honey on the habit are vertigo, nausea, and delirium.

Honey is at first smooth and homogeneous like syrup, but, after it has been kept for some time, it contains brilliant, granular crystals, dispersed through a clear, uncrystallizable fluid: the colour varies from pure white to a deep brownish-yellow: its odour is somewhat aromatic; its taste sweet, sharp, and slightly acidulous. When long kept, Honey acquires a deeper colour, and more sharpness of flavour and taste. It is completely soluble in water, but only partially soluble in alcohol, which takes up the fluid or syrupous part, and leaves the crystallizable untouched. Boiling alcohol, however, dissolves the whole; but, on cooling, deposites crystalline granules, which closely resemble grape sugar. The quantity of crystallizable matter varies in different kinds of Honey, but abounds most in the best kinds. M. Guibourt alleges that it contains, also, *Mannite*, a peculiar kind of sugar, which constitutes a large part of manna; and I

* Plantes remarq. de Brezil, vol i.

would add, it contains an acrid matter, which probably is the source of its laxative property. It may be regarded as consisting of saccharine matter, or sugar and mannite; mucilage; an odorous principle; an acrid principle; and a free acid. Like most other vegetable products of a saccharine nature, nitric acid converts it into oxalic acid.

Honey is laxative; but it is apt to gripe and prove flatulent when given in quantity sufficient to move the intestines: and the older the Honey, the more likely these effects are to be produced. It is, therefore, seldom employed in this country for purgative purposes.

Vegetable Productions, containing

b. SACCHARINE COMBINED WITH ACRID MATTER.

Under this head I have placed all those laxative substances, medicinally employed, which contain a large proportion of sugar. The greater part of the sugar used in Europe is procured from the sugar cane, Saccharum *officinarum*. When well purified, it is in solid and brittle crystalline masses, white, inodorous, sweet, and persistent in the air. It is soluble in half its own weight of cold, and to any extent in hot water. According to the analysis of Dr. Prout, 100 parts of loaf sugar consist of 42·85 parts of carbon, 50·8 of oxygen, and 6·35 of hydrogen, or 1 eq. of carbon = 6·12, + 1 of water = 9, making its equivalent 15·12. The alkalies combine with it and form compounds, which do not taste sweet. Sulphuric acid changes it to charcoal; nitric acid to oxalic acid. The Saccharine Matter in fruits does not readily crystallize; and a sugar resembling that of fruits is made from starch by the action of sulphuric acid.

1. PULP OF CASSIA. *Cassia.* L. *Cassiæ Pulpa.* E. D.—This is the pulp of the fruit of a tree, a native of the East Indies, and of Egypt, where it was called Chiavxambar, the name Cassia *fistula* being applied by the ancients to cinnamon. The tree is now named Cathartocarpus *fistula:* it is cultivated in Egypt, but found in a wild state in Hindostan, throughout the Indian Archipelago, in Cochin China, the Antilles, and in South America, where, however, the fruit differs in several respects from that of the tree of the old Continent. It belongs to the natural order Leguminosæ*. The tree rises about forty feet in height, with pinnated leaves, yellow papilionaceous flowers which hang in pendulous clusters. The fruit is a long, woody, dark-brown pod, nearly two feet in length, about an inch in diameter, cylindrical, with two longitudinal furrows on one side, and one furrow on the other. It is internally divided into cells by transverse

* Woodville's Med. Bot third edition, p. 160, pl. 455. London Dispensatory, art. Cassia. Richard, Hist. Nat. Med. t. ii, p. 525. Hayne, xi, 39. Lindley, 262.

partitions: each of the cells contain an oval, shining, yellowish seed, with red lines dividing it longitudinally, imbedded in a soft, black pulp.

The pods are permitted to remain on the tree for a year. Prosper Alpinus says that they must be kept four months before they can be used. In choosing them, the heaviest pods and those which do not rattle are to be preferred.

The pulp is the only part in use as a medicine. It is, when good, of a black colour, and free from mouldiness, has a slight sickly odour, and a sweet, mucilaginous taste. It is soluble in water, and partially soluble in alcohol and ether. The watery solution yields a precipitate with diacetate of lead, marking the presence of gum; and, although none of the mineral acids affect it, yet chlorine throws down a yellow-coloured precipitate, which is insoluble in ether. From an analysis of this pulp, Vauquelin says that it contains nearly one half its weight of *water*, rather more than one fourth part of *sugar*, some *gluten*, *gelatin*, *gum*, and *extractive matter*. According to M. Henry, its components are 61 per cent. of *sugar*, + 6·75 of *gum*, + 13·25 of *tannin*, with *colouring matter* and *water**.

The Pulp of Cassia fistula is seldom used in this country, being apt to induce nausea, griping, and flatulence; it is an ingredient in the Confectio Cassiæ, and the Confectio Sennæ. When taken alone, the urine becomes tinged of a brownish colour; but this is merely a separation of the colouring matter. In doses of from ℥i to ℥ii, it proves gently laxative; but it is a medicine which does not deserve to be retained in the Pharmacopœias.

Confection of Cassia, *Confectio Cassiæ*, L. *Electuarium Cassiæ*, D. is prepared by bruising ℥ii of manna, and having dissolved it in f℥viii of syrup of roses (lb.ss of syrup of orange, D.), adding to the solution lb.ss of cassia pulp and ℥i of tamarind pulp, and evaporating the whole to the consistence of a confection. The dose is ʒi to ʒiv.

Manna. *Manna*, L. E. D. — This is the concrete juice of the Ornus *Europea*, a native of the South of Europe, Sicily, Mount Parnassus, and the loftiest mountains of Greece. It is a low, but a handsome tree, seldom rising more than twenty feet in height, with pinnated leaves, resembling those of the common ash: it belongs to the natural order Oleaceæ†. But two other species of Ornus, the C. *rotundifolia* and *excelsior*, yield the best Manna; and, besides the different species of Ornus, the Tamarisk and the Eucalyptus *mannifera* also yield Manna. It exudes from the bark of the stem and branches, upon which it concretes; but to obtain

* Journ. Chem. Med. tome ii, p. 376.

† Woodville's Med. Bod. third edition, p. 200, p. 589. London Dispensatory, art. Fraxinus. Richard, Hist. Nat. Med. t. ii, p. 22. Hayne, xiii, 12. Lindley, 547.

it for medicinal purposes, incisions are made into the bark, on one side only of the tree in the same season. It is, also, said to exude from the puncture of an insect, the Tettigonia *Orni;* this forms the granular manna. As it flows, it is viscid and nearly colourless; but as it concretes, it acquires colour, and assumes a stalactitic aspect. Sometimes the Manna is collected on straws and chips fastened near the incisions, by which a finer kind is procured. In this state it is called canulated Manna, *Manna in Canoli.* The best Manna brought to this country is closely packed in chests, and is known by the name *Flake Manna* (Manna gerace of the Sicilians). It is in flakes, or oblong pieces, evidently moulded by the twigs or branches on which it has concreted: it is light, friable, of a white or very pale-yellow colour, and is in some degree semi-diaphanous. It has a slight, faint, peculiar odour, a somewhat sharp, sweetish taste, leaving a bitterish impression on the tongue. The finer pieces are often crystallized in the interior*. It softens in the hand; melts at a temperature of 108; is soluble in three parts of water, without suffering any alteration, and is obtained unchanged by evaporating the watery solution. It is readily dissolved in boiling alcohol; and, when the solution cools, about three fourths of the quantity dissolved is deposited in a crystallized state, not unlike the appearance of disulphate of quina. This has been named *Mannite;* and is ordered, by Prout, who named it, to be purified by pressing it between bibulous paper, and then redissolving it in boiling alcohol. It instantly melts in the mouth, is agreeably sweet, and completely free from the nauseous taste of the Manna, which adheres to the part retained in solution by the alcohol. Its crystals, when well formed, are circular, four-sided prisms. Mannite is soluble in five parts of cold water; but nearly insoluble in cold alcohol. It differs from sugar in not being fermentable; yet, when treated with nitric acid, it is converted partly into oxalic, partly into saclactic acid. According to Dr. Prout, it consists of 38·7 of carbon, + 54·5 of oxygen and 6·8 hydrogen; but according to Liebig and Pelouze, the proportions are C. 39·56, + H. 7·69, + O. 52·75, = 100·00; or $C.^6 H.^7 O.^6$ equiv. = 95·72. On evaporating the spirituous solution, more mannate is obtained; and, finally, a thick extract, which cannot be rendered perfectly dry, and which contains the nauseous principle of the drug. When Manna is treated with nitric acid, it yields, besides oxalic, saclactic acid. According to the experiments and analysis of Vauquelin, Manna consists of about 60 per cent. of *Mannite,* a little *common sugar,* and about 32 per cent. of a yellow, nauseous, *uncrystallizable matter,* which is its

* Besides the Flake manna, there are some inferior sorts in the market, known by the names *Sicilian, Tolfa,* and *Calabrian* Mannas.

purgative principle*, and a little *mucilage;* whence the origin of the saclactic acid, when it is treated with nitric acid.

Manna was formerly in great vogue. It is a very mild laxative, adapted chiefly for children and very delicate females; but even for these it is seldom prescribed alone. It is ordered as an adjunct to solutions of neutral salts, castor oil, and senna; but it is rather adapted to cover their tastes than to aid their cathartic properties. It may be given in doses of ℥i to ℥ii, in any bland solution or in milk. It is one of those medicines which might be well spared.

c. ACIDULOUS FRUITS.

The laxative influence of these fruits seem to depend on a combination of sugar, gum, the tartaric, citric, and malic acids.

1. TAMARINDS. *Tamarindorum Pulpa.* L. E. D.—This is the pulp of the fruit of the Tamarindus *Indica*, a beautiful tree, a native of the East and West Indies, Arabia, and Egypt, belonging to the natural order Leguminosæ†. It forms an article of diet in the countries where it is produced. West India Tamarinds have a short, broad legume, with from one to four seeds. They are imported, preserved in syrup, after being freed from the outer shell: those sent home from the East Indies consist of long, narrow, six-seeded pods, preserved without sugar, and dried in their natural state‡. Unless, however, they are kept in closely covered jars, they are very apt to get musty.

Tamarinds are inodorous, and have an acid, agreeable, sweet taste. Their goodness is ascertained by their freedom from mustiness, by the seeds being hard, flat, and clean, and by the strings or fibres which embrace the pulp being entire; and a clean knife, thrust into the preserve and left there for some time, not appearing coated with copper when withdrawn. According to the analysis of Vauquelin, the pulp, independent of the sugar of the preserve, contains 9·4 of *citric acid,* 3·25 of *bitartrate of potassa,* 1·5 of free *Tartaric acid,* 0·55 of *Malic acid,* in combination with 12·5 of *sugar,* 4·7 of *gum,* 6·25 of *jelly and fecula,* 34·35 of *fibre,* and 27·55 of *water.* These acids are precipitated in combination with lead, when solutions of the acetates of lead are added to a solution of Tamarinds; on which account, the infusion of Tamarinds should not be drank when acetate of lead is prescribed in hæmorrhages.

Tamarind Pulp is a weak, but an agreeable laxative. It requires to be given in substance: for, however strong the infusion or decoction may be, it produces no action on the intestinal canal. From the extent of the dose required to move the bowels, it is

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* Rose.

† Woodville's Med. Bot. 3rd ed. pl. 161, p. 448 London Dispensatory, art. Tamarindus. Richard, Hist. Nat. Med. t. ii p 728. Hayne, x. 41. Lindley, 296.

‡ Tamarindus *Indica* and T. *occidentalis* are varieties of the same species.

seldom given alone, but generally combined with some neutral salt, or with rhubarb or infusion of senna*. It is of little value as a laxative; and should be only tolerated in the Pharmacopœia, as forming an agreeable refrigerant whey, when ℥i of it is boiled in a pint of milk.

2. PRUNES. *Pruna.* L. E. *Pruna Gallica.* D.—The tree, Prunus *domestica*, which yields this fruit, is a native of Syria; but it grows well in all the temperate parts of Europe. It belongs to the natural order Amygdaleæ†. The fruit is a drupe, which ripens from August to October. It is dried by artificial heat; in some places, in the sun; and is sold under the name of prunes. The best prunes are the dried small Damascus or the St. Julian plums. It is probable that some of the sugar which they contain is the result of their drying; the quantity in the ripe fruit being 11·5 per cent‡. For aperient purposes, the parenchyma of the Prune is softened by putting dried fruit into hot water; and in this state it operates as a mild laxative. Prunes, however, are seldom or never prescribed as medicine in this country; nor is the employment of them as a domestic remedy so general as on the Continent. They enter into several purgative formula; but they add little to their cathartic properties.

d. FIXED OIL.

When a large dose of Fixed Oil is taken into the stomach, it is little acted upon by the digestive faculty, and passes unaltered into the intestinal canal, where it excites an increased peristaltic movement, and is at length ejected, displaying its presence in the alvine evacuations. There are three of the Fixed Oils employed as laxatives, although not very frequently in this country.

1. OIL OF OLIVES. *Olivæ Oleum.* L. E. D.—This oil is procured by expression from the ripe fruit of the Olive, Olea *Europea*, a tree which is a native of Asia Minor and Africa, and is most abundantly cultivated in Spain, the South of France§, Italy, and Greece; and which belongs to the natural order Oleaceæ‖. The best olive oil is that which is obtained by gentle pressure from the fully ripe drupe, previously crushed in a mill. An oil of a second kind is procured by re-pressing the residue; and even two other qualities are procured by succeeding pressure, aided by pouring boiling water over the marc. Good

* Infusum Sennæ cum Tamarindis, E. D. Confectio Sennæ, L. E. D.

† Woodville's Med. Bot. third edit, p. 520, pl. 187. Richard, Hist. Nat. Med. t. ii, p. 448. Hayne, iv, 43. Lindley.

‡ Berard.

§ It was introduced into the South of France 700 years before Christ, by the Phœnicians.

‖ Woodville's Med. Bot. 3d edit. p. 280, pl. 93. London Dispensatory, art. Olea. Richard, Hist. Nat. Med. t. ii, p. 17. Hayne, x, 10. Lindley, 547.

Olive oil should be inodorous, insipid, soft, and agreeable in the mouth; the best is that which is made in Provence, of pale straw colour, and perfectly transparent. Its density, at 77° Faht. is 911. At a low temperature it becomes a granular concrete mass. It consists of 28 per cent. of *Mangarin* and 72 of *elaine;* according to Gay Lussac and Thénard, of 77·212 Carbon, + 13·36 Hydrogen, + 9·427 Oxygen, = 100·00.

When an ounce or more of this oil is taken into the stomach, it resists its digestive power and passes into the intestinal canal. Besides operating as a gentle aperient, it allays colic and gripings; and hence has been found useful in dysenteric affections. It is also given with advantage as an enema, in doses of from two to three ounces or more, when the large intestines are suffering under inflammation, or from abrasions. It is also useful as a vermifuge in removing ascarides.

2. Oil of Almonds. *Amygdalæ Oleum.* L.—This oil is procured from the kernel of the fruit of the Almond tree, Amygdalus *communis**, by expression. It is chiefly from the Bitter Almond that it is expressed: and it is perfectly equal in every respect to that obtained from the sweet Almond. It is inodorous, has an agreeable bland taste, and is totally devoid of acrimony. It is of a pale greenish-white colour, and does not congeal at a temperature of 9° Faht. Its density is 917 to 920. It is turbid when newly drawn, but is readily clarified either by rest or filtration. One hundred parts of Almonds yield forty-six of oil. And one hundred parts of the oil consists of seventy-six of *elaine* and twenty-eight of *stearine.* It dissolves in 24 parts of cold and 6 parts of boiling alcohol. Ether also dissolves it. As a laxative, it operates exactly in the same manner as olive oil.

3. Linseed Oil. *Lini Oleum.* L. E. D.—This oil is also obtained by expression, from the seeds of the Lint plant, Linum *Ussitatissimum*†, one of the most valuable plants which has been naturalized to our climate. It is a native of Egypt, in those parts which are subjected to the inundations of the Nile; but is naturalized to this climate. It belongs to the natural order Linaceæ. When the oil is cold drawn, it has a greenish-white colour, and a mild, soft taste; but, when heat is employed, it is acrid, nauseous, and in every respect disagreeable. Its density is 927 to 950‡. It is soluble in 40 parts of cold and 5 parts of boiling alcohol, and in less than 2 parts of ether. One hundred parts of Linseed yield about twenty-two of oil. It is a more certain laxative than either Olive or Almond oil. A table-spoonful of it, taken at short intervals, gently purges; but if it

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* Woodville's Med. Bot. third edition, p. 507, pl. 183. London Dispensatory, art. Amygdalus. Richard, t. ii, p. 439. Hayne, ix. 29. Lindley, 231.

† Ibid, p. 566, pl. 202. Richard, t ii, p. 795. Hayne, vii, 17. Lindley, 129.

‡ Gieger.

be mixed with syrup, it ceases to operate as a laxative. It has been administered with advantage in inflammatory and spasmodic affections of the bowels. It has also been found useful in nephritic complaints.

* * *Inorganic Substances.*

e.—SULPHUR. *Sulphur.* L. E. D.—The nature of this simple combustible has been already explained. The Sulphur of both England and Sicily contains several impurities; it is therefore sublimed, and rises in vapour before it is completely fused. In this way it is refined on a great scale, by conducting the vapour of the melting sulphur into large close chambers, where it is deposited in the form of fine powder; and on a small scale, by being melted in an earthen cucurbit, and the vapour collected in a series of glass vessels, named aludels. The Edinburgh College orders it to be prepared in the following manner.

SUBLIMED SULPHUR. *Sulphur Sulimatum.* E.—"Sublime Sulphur in a proper vessel; wash the powder with boiling water in successive portions till the water ceases to have an acid taste; then dry the sulphur with a gentle heat."

Sublimed Sulphur is in the form of a very bright-yellow powder. It is sometimes, also, obtained in another form for medicinal use—namely, by precipitation from any liquid holding it in solution; for example, by the decomposition of a sulphuret of lime, prepared by boiling together one part of Sulphur, two parts of quick lime, and thirty-two parts of water. When hydrochloric acid is added to this compound, the Sulphur, retaining a little hydrogen and water, is precipitated, and sulphuretted hydrogen evolved*. Sulphur, in the same state, is procured by receiving the vapours of common Sulphur in a vessel filled with steam or watery vapour. It is much whiter than washed flowers of Sulphur, and is called precipitated Sulphur, or Lac Sulphuris. It is evidently a combination of water and Sulphur, or a *Hydrate of Sulphur*. When heated to 224° and 230° of Faht. it melts and becomes as fluid as water, and rises in vapours. If allowed to cool after being melted, and if the fluid Sulphur be poured out as soon as the surface begins to congeal, the under part of the cake will be found crystallized in needle-shaped crystals of an octohedral figure. When heated to 320°, Sulphur becomes thick and viscid; and if then poured into water, it assumes a red colour and acquires a ductility like wax, whilst its specific gravity is increased. When heated in the air to 600, it inflames and is acidified. Alcohol, ether, and fat oils dissolve a small portion of it.

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* Precipitated Sulphur is no longer an officinal preparation.

Sulphur combines with chlorine, iodine, hydrogen, phosphorus, and oxygen; and forms various compounds, some of which are medicinal agents. It is sometimes contaminated with sulphuret of arsenic. This may be ascertained by converting the Sulphur into sulphuric acid by means of nitric acid, aided by heat, then neutralizing with carbonate of soda, adding hydrochloric acid in excess, and, lastly, transmitting through it a stream of sulphuretted hydrogen; if arsenic acid be present, a yellow sulphuret of arsenic will be formed.

Such are the chemical properties of Sulphur; and it is of importance that the medical practitioner should know them, in order to understand some of the effects of this medicine upon the body. As a laxative, its operation is gentle; and it is the very best laxative that can be administered in hæmorrhoids; as, without exciting purging, it produces a soft, easily moulded evacuation, which does not irritate by its physical pressure upon the highly sensitive piles. In this case, it is usually combined with magnesia; and, in other cases, to quicken its operation, with bitartrate of potassa. In habitual dyspnœa, in which it is of great importance to keep the bowels soluble, it is admirably adapted to fulfil every indication desired. In these cases, the precipitated Sulphur is the best form of the remedy. In doses of ʒi combined with gr. x or gr. xv of magnesia, it acts gently upon the bowels, and may be continued daily, at this dose, until it manifest its odour on the skin, when its employment may be intermitted for a few days.

f. Magnesia. *Magnesia*, L. E. *Magnesia usta*, D.—This is an oxide of a metal named Magnesium. It is found native in the state of a *hydrate* of *Magnesia;* in which condition it is of a snow-white colour, passing into greenish-white, and having a foliated fracture. Magnesia is soft; adheres to the tongue; and is soluble in acids. In this state, the native mineral contains about 70 per cent. of Magnesia and 30 of water. In *Steatite*, another magnesian fossil, the proportion of Magnesia is 30 per cent. Magnesia, for the purposes of medicine, is prepared from the Carbonate of Magnesia, by subjecting it to the action of heat until all the carbonic acid is expelled from it, and the simple oxide, or *Calcined Magnesia*, as it is termed, remains; but if too much heat be employed, the Magnesia partially vitrifies and runs into masses. In this process, the carbonic acid combines with caloric and flies off in the form of carbonic acid gas. The carbonate loses about 60 per cent. of its weight, of which from 15 to 20 per cent. are water, and the remainder carbonic acid gas. In well-prepared pure Magnesia, the components are one eq. of Magnesium $= 12{\cdot}7$, $+$ 1 of oxygen $= 8$, equiv. $= 20{\cdot}7$, or of Magnesia 60, $+$ oxygen 40, $= 100$.

Magnesia is a pure, white, inodorous, insipid powder. It is nearly insoluble in water, requiring more water at 212° than

at 60° for its solution. It does not evolve heat when it is mixed with water. It is re-converted into the carbonate when it is exposed to the action of the atmosphere, owing to its powerful affinity for carbonic acid, which is always floating in the air. It is sometimes adulterated with lime; but the fraud is easily detected by dissolving the suspected magnesia in diluted hydrochloric acid, and testing with oxalate of Ammonia, which throws down the lime in the form of an oxalate. It may also be detected by triturating the magnesia with bichloride of mercury, which will form a yellow colour if lime be present. Alumina is detected by dissolving the Magnesia in hydrochloric acid and precipitating with an excess of Ammonia: the acid should be in excess, otherwise the alumina will not be thrown down.

c. Carbonate of Magnesia. *Magnesiæ Carbonas.* L. E. D. — This substance, formerly known by the name of *Magnesia alba*, was prepared by precipitating the mother liquor of nitre. It was invented by an Italian priest in the beginning of the eighteenth century; and was sold at Rome as a nostrum, under the name of Count Palmer's Powder, for the cure of all diseases. A few years afterwards, Valentini informed the public how it might be prepared from lixivium, or the *mother ley*, which remains after the preparation of nitre. Slevoyt then discovered that it might be prepared by precipitating this ley with potassa; but the real nature of the preparation was not known until Dr. Black published his dissertation on the subject in 1753.

Carbonate of Magnesia is ordered, in the Pharmacopœias, to be prepared by precipitating the sulphate of Magnesia with carbonate of soda, washing the precipitate and drying it. In this process a double decomposition takes place. The sulphuric acid leaves the magnesia and unites to the soda of the carbonate, whilst the carbonic acid combines with the magnesia of the sulphate. Carbonate of magnesia is insoluble and is precipitated; whilst the large quantity of water employed holds the sulphate of soda in solution. Carbonate of soda is preferable to Carbonate of potassa, because the sulphate of soda formed is more soluble than the sulphate of potassa, and consequently more easily washed out of the precipitate. Carbonate of Magnesia is also prepared by precipitation from *bittern*, the lixivium which remains after the crystallization of common salt, and which is a Chloride of Magnesium. The bittern is heated to 212°, and the impure carbonate of soda added to it; after which the fire is withdrawn. In this process the Chlorine leaves the Magnesia and attaches itself to the base of the soda, which is deoxidized, forming a Chloride of Sodium, which is soluble, and therefore retained in the water of the process, whilst the carbonic acid unites to the Magnesia which is set free, and forms

an insoluble carbonate of Magnesia, which is precipitated. This precipitate is then extremely well washed, and brought to market in square masses.

Carbonate of Magnesia is a pure white, light, elastic powder, inodorous, and nearly insipid, insoluble in water, but converting the vegetable reds to blue and green, being feebly alkaline. Heat does not melt it; but it becomes luminous when exposed to a very strong heat. It is a hydrated carbonate, composed of 47·6 parts of Magnesia and 52·4 of carbonic acid in 100; or, according to Berzelius, of 36·263 of carbonic acid, 43·956 of Magnesia, and 19·781 of water; or of 1 eq. of Magnesia = 20·7, 1 of carbonic acid = 22, making the equivalent 42·7. If it be not well washed, it will contain Sulphate of Magnesia, which may be detected by dissolving the Carbonate of Magnesia in nitric acid and adding nitrate of baryta: if the sulphate be present, an insoluble sulphate of baryta will be formed; but if the adulteration be lime, sesquicarbonate of ammonia will throw down a precipitate in the nitric solution.

This preparation is converted into a *bicarbonate*, which is crystallizable, by diffusing it in water and passing carbonic acid through the mixture; or, what is more convenient, by mixing together a solution of 125 parts of Sulphate of Magnesia and 136 of bicarbonate of soda, filtering and leaving the solution to spontaneous evaporation. The salt thus prepared is in the form of hexagonal prisms, nearly tasteless, dissolving more abundantly in cold than in hot water, owing to the latter expelling a portion of the carbonic acid, and reducing the salt to a state of a carbonate. The preparation called Dinneford solution of Magnesia is said to contain about 5 per cent. of its weight of Carbonate of Magnesia, about 17 to 19 grains in every fluid ounce: my experiments, however, confirm Dr. Christison's, that the quantity does not exceed 9 grains.

d. Acetate of Magnesia. *Magnesiæ Acetas.*—This salt, which has not a place in the Pharmacopœias, may be formed by dissolving Magnesia in acetic acid. It does not crystallize, but forms a viscid mass. It has a sweetish taste, with a slight degree of bitterness: is deliquescent, and very soluble in water and alcohol. It consists of 65·96 of acetic acid, + 34·04 of Magnesia, = 100.

e. Citrate of Magnesia. *Magnesiæ Citras.*—This salt is also readily prepared by combining its constituents, Magnesia and citric acid. It does not crystallize, even when it is evaporated to the consistence of syrup; but it forms a white, spongy, opaque mass, which rises in the vessel like a mushroom.

Both the acetate and the citrate Magnesia may be formed as extemporaneous preparations by combining their constituents at the moment of administering them.

All these preparations of Magnesia are simple laxatives: they

operate mildly, and yet with sufficient energy, when they meet with acid enough to convert them into the chloride of magnesium or the acetate. When the acidity of the stomach is so small that the Magnesia remains uncombined in the stomach, it does not operate even as a Laxative; and in this case lemon juice or vinegar and water should be drank immediately after swallowing the Magnesia, which is thus rendered active. As a Laxative, Magnesia is preferable to the carbonate, the extrication of the carbonic acid in the stomach rendering the carbonate very inconvenient. Like many other alkaline substances, Magnesia allays the irritability of the stomach and checks nausea; I have seen a dessert spoonful of Magnesia in a glass of sherry wine allay very distressing vomiting. When it does not act freely as a Laxative, and has been taken for some time, it is apt to form into concretions. Those persons, therefore, who take it in small doses with the view of obviating a tendency to the formation of urinary calculi, should frequently clear out the intestinal canal with a brisk purgative.

The magnesian preparations are well adapted for infants and children, as the prevailing acescency of the stomach and intestines insures their operation, and the irritability always attendant on dentition is greatly allayed by the Magnesia operating on the sentient nerves of the stomach. The dose of the Carbonate of Magnesia to an adult is from ℈i to ʒi; that of the pure Magnesia, from gr. xv to ℈ii. The best vehicle for taking it is milk.

B. PURGATIVES.

This division of Cathartics contains no animal purgative that I am aware of; and those which are vegetable products, although they may be, in some degree, digestible substances, yet are not dietetical.

* ORGANIC PRODUCTS WHICH OPERATE AS PURGATIVES.

a. FIXED OIL, WITH AN ACRID PRINCIPLE.

This consists of fixed oil, holding in solution an acrid principle, which is the real purgative agent.

1. CASTOR OIL. *Ricini Oleum.* L. E. D.—The Ricini *communis*, or Palma Christi, which yields this oil, is a plant known from an early period, and generally diffused over most of the countries within the tropics. It has been cultivated as an ornamental plant in this island since the year 1562. From its being a native of Greece, the plant was well known to Dioscorides*, who mentions it under the names *kiki* and *kroton*, from the resemblance of its seeds to the insect termed Tick, which is

* Op. lib. iv. cap. 164.

frequently found upon the ears of dogs; and its present name, Ricinus, is a Roman appellation, derived from the same source. It is an annual plant, when grown in this country; but Roxburgh and some other writers inform us that it is perennial within the tropics. It belongs to the natural order *Euphorbiaceæ**, is of quick growth, sometimes, in favorable situations, rising to the height of sixteen feet or more, and even becoming woody†. The stem is glaucous, or purplish-red, jointed and channelled: the leaves large, palmy, with 7 sigments. The flowers are in long green spikes, on the divisions of the branches. The fruit is a prickly capsule. The seeds, which are ovate, black, shining, and dotted with grey spots, abound with oil; but that contained in different parts of the seed possesses different properties. It is unnecessary to enumerate the opposite statements on this subject, by authors, from the time of Serapion to the present period. M. Guibourt has finally decided the question. He found that the testa or husk of the seed contains no acrid principle, and merely gives colour to the oil when this is expressed; that the embryon or germ, although in taste it seems to possess more acrimony than the perisperm, yet, is not the sole seat of the acrid principle; that the perisperm, or cotyledons, contain both the acrid and the oily principle; and that the acrid principle is volatile, and may be dissipated by boiling the oil in water. According to Geiger, the quantity of fatty oil in the seeds is 46·19 per cent. It exists in the nucleus of the seeds, in combination with 2·40 of *Gum*, 0·50 of *albumen*, and 20·00 of *lignin*‡. It is procured by different processes from the seeds, by the aid of heat and by simple pressure. The first method has been employed since the time of Dioscorides, and with little alteration. The bruised seeds are put into a bag, and suspended in boiling water, until the oil is extracted and rises to the surface, when it is skimmed off. In some places the seeds are decorticated, then beaten into a paste, which is boiled in four or five times its weight of water, and the oil is skimmed off as it rises to the surface. It is next heated in another vessel until the water is driven off, and is then passed through a strainer. In the southern provinces of India, the seeds are soaked for several days before they are bruised. When the boiling is too long continued, the acrid principle is dissipated; if the heat be too great, the oil becomes extremely acrid and high coloured. The great difficulty, therefore, of always determining the exact

* Woodville's Med. Bot. 3rd edit. pl. 221, p. 624. London Dispensatory, art. Ricinus. Richard, Hist. Nat. Med. t. i, p. 590. Hayne, x, 46. Lindley, 183.

† Ray. Hist. Plant. i, p. 166. It is uncertain whether the following, enumerated by Nees Von Essenbeck (Handb. d. Med. Pharm. Bot.)—Ricinus *Africanus*, R. *lineocarpus*, R. *lividus*, R. *macrophyllus*, and R. *viridis*—are varieties or distinct species.

‡ Handb. de Pharm. Bot. ii. § 1671.

point of temperature was the chief cause for the introduction of the press for obtaining the oil from the seeds of the Ricinus *communis*. Another disadvantage of the oil obtained by coction is the tendency which it has to become rancid. The greater part of the oil now used is procured by pressure*. The finest oil is prepared by decorticating the seeds†, reducing them to a paste, either in the mortar or by grinding in a mill, and placing this paste in hempen cloths or bags, subjecting it to the press without heat. But the expensive and tedious nature of this process prevents it from being frequently employed; hence the seeds are ground without decortication, and pressed, in bags, between iron plates. The oil is then clarified by rest, and filtered when cold: or it is heated with water until the water boils, which throws up a scum that is separated; after which it is strained through flannel. The cold-drawn East India oil is most esteemed in this country.

In whatever manner obtained, good Castor Oil is thicker and heavier than the usual fat oils, and more transparent, of a greenish-yellow or amber colour; sometimes it is reddish, when much heat has been employed in pressing the seeds. It should have little or no odour, and at first only a slightly mawkish, sweet taste, which is succeeded by a sensation of acridity, *arriere gout*, as the French term it. It is lighter than water, its sp. gr. being 0·969 at 55° Faht. When exposed to the air, it thickens without losing its transparency; yet it does not congeal until cooled below zero.

In its chemical properties, Castor Oil seems to hold an intermediate space beneath the volatile and the fixed oils. Like the former, it is entirely soluble in twice its weight of strong alcohol—a circumstance which affords an excellent test of its purity; for if it contain any admixture of fat oil, the solution is imperfect and milky. Indeed, Castor Oil may be procured from the bruised seeds digested in alcohol, and the spirit afterwards separated by distillation. The oil thus obtained is more active than that procured by expression; but it has this disadvantage, it becomes sooner rancid. In this process the whole of the acrid matter is taken up by the alcohol; whilst only a portion of it is mixed with the bland oil, when castor oil is procured by coction with water or by expression‡. Rectified sulphuric ether also dissolves Castor Oil in any proportion§. Castor Oil is as unctuous

* This method of procuring the oil was first employed in the West Indies about sixty years ago.

† At Calcutta, the seeds are always shelled before they are pressed.

‡ This property of Castor Oil to dissolve in alcohol has led to its abuse in the adulteration of essential oils, particularly oil of cloves; as it cannot be detected by dissolving the oil in alcohol.

§ This solution in ether has been found to be a useful local application in rheumatic pains of the joints.

as fat fixed oils, boils at a temperature under 600°, and is decomposed. It forms soap with the mineral alkalies, and attracts oxygen, and becomes more viscid when exposed to the air. When saponified, it yields ricinic, cloiodic, and margaric acids; and it form glycerine. When distilled per se, I found that it gives over three distinct products, besides a considerable quantity of inflammable gas, which burns with a blue flame, resembling that of carbonic-oxide gas. The first product which swims uppermost in the receiver is of a deep straw colour, has a most penetrating, pungent odour, and a hot acrid taste, and is decidedly acid; the second resembles margaric acid, in being crystallized, melting at 134°, and again crystallizing on cooling, and dissolving in alcohol, but not in water; the third, which is heavier than the other two, is as colourless as water, acid to the taste, has an oleaginous odour, and some of the pungency of the first product: what remains in the retort is black, thick, tenacious, and evidently contains much carbon. As these products are the results of a decomposition and recombination of ultimate constituents, this method of treating Castor Oil does not throw any light on the nature of its acrid and purgative principle. When, as I have already said, it is boiled in water, it loses its activity, and may be eaten as salad oil; from which it is evident that the active principle is volatile.

The ancients employed Castor Oil chiefly as an external application; and it is still used in India in ring worm, porrigo, and many other cutaneous diseases. The active principle is not confined to the fruit; for the bark, both of the root and the stem, purges powerfully; and, when made into balls, in conjunction with chillies and tobacco leaves, we are informed by Dr. Ainslie, it is an excellent remedy for gripes in horses*.

The greater part of the Castor Oil now employed, is imported from India. It is brought over in casks, and skin bottles or *duppers*. It is paler coloured, is less nauseous, and less active than the West India oil, which is generally prepared by coction with water. Scarcely any West India oil is now brought to market; instead of which, much of the East India oil is exported to some of the West India islands.

As a Cathartic, Castor Oil operates quickly, with little irritation, and effectually clears out the bowels. The seeds, which were more frequently employed by the ancients than the oil, are more drastic in their operation, and having, in some instances, proved fatal†, they are, therefore, now scarcely ever employed. This difference between the seeds and the oil depends on the acrid principle being separate from the bland oil in the cotyledons of the seed, and adhering more tenaciously to the farinaceous part of the seed than the bland oil. The acrid

* Mat. Med. of Hindostan, vol. i. p. 256. † Lond. Med. Gaz. xix, 944.

principle is dissolved in the bland oil by the process of expression; but a large portion of it is left in the mare, which is an active Cathartic, after all the oil is expressed from it. From its quick and mild operation, Castor oil is peculiarly adapted for children, puerperal women, and all cases in which the evacuation of the intestines is required, with little constitutional disturbance. Experience has ascertained that it is the best purgative that can be employed in that affection of the bowels which is caused by swallowing carbonate of lead—namely, colica pictonum, or Devonshire colic; and it is the more useful in that disease, as it may be joined with opium, and other narcotics, without having its purgative properties lessened. For the same reason, Castor Oil is advantageously given in calculous affections. It has been, also, regarded by some Continental physicians, particularly Drs. Odier and Dumont of Geneva, as peculiarly well suited for expelling the tape worm, Tenia *lata;* but it possesses no specific properties in such cases. Exhibited per anum, in large quantity, I have found it very useful in destroying the small thread worms, *ascarides*, which often infest the rectum. No purgative with which I am acquainted can be more relied upon for combating habitual costiveness than Castor Oil, when properly administered. For this purpose, a large dose must first be given in the morning, and the use of the oil continued daily for some weeks: gradually diminishing the dose, until half a tea-spoonful only is taken: on leaving off which, the bowels continue to be relieved without further artificial assistance*. One disadvantage attending the use of Castor Oil, is its tendency to excite vomiting; but this is counteracted by combining it with some aromatic. The best modes of exhibiting it, in general, has been much canvassed: it is given floated on water, with a small portion of brandy poured over it; and, when this can be swallowed at once, there is no better mode: but as this cannot always be done, it has been given in warm milk, in coffee, and in ale, according to the taste of the patient, as all these vehicles cover the flavour. Where there is much objection to the taste, it may be conveniently formed into an emulsion with mucilage of gum, or the yolk of egg, and cinnamon or peppermint water.

The dose of Castor Oil for an adult, to produce its full effect, is from fʒiv to f℥iss; but, as I have already stated, Castor Oil has such a tendency to leave the bowels relaxed, that a few drops is sometimes an adequate dose for those who have long taken the medicine. When the oil cannot be retained on the stomach, it has been proposed to administer an emulsion of the decorticated seeds, when these can be procured free from rancidity. The seeds are first reduced to a pulp or paste, and water gradually added as long as any milky fluid is produced: this emulsion

* Dr. Cullen first observed this property.

purges briskly, without much inconvenience. Upon the whole, Castor Oil is a purgative of great value.

b. OLEO-RESINS.

These consist of *volatile oil* in that state of combination with resin which is found in those semifluid substances known by the improper names of *Balsams*, and the *Turpentines*. All these substances agree in certain qualities; but they differ in the nature of the essential oil which they contain.

2. COPAIVA. *Copaiba.* L. E. *Copaiferæ Resina liquida.* D. —This Oleo-Resin is obtained from boring the stems of some of the numerous species of the genus Copaifera. Indeed, all the species yield Copaiva; but the greatest quantity of that which is brought to this country is yielded by the Copaifera *Multijuga*, which grows in the province of Para. M. Hayne thinks C. *bijuga* is the species referred to by Piso and Maregrav, who first mentioned Copaiva in 1648. The Copaiva brought to this country under the name of West Indian, is of an inferior quality, and the product of another species, the C. *Jacquini* of Desfontaine, C. *officinalis*, Lin. The C. *Langsdorfii*, designated by the London College, and C. *Coriaceæ*, furnish the Copaiva brought from Rio Janeiro. The genus belongs to the natural order Leguminosæ*. The C. *Multijuga* of Hayne is a handsome tree, with abruptly pinnate leaves, consisting of six to ten pairs of somewhat incurved, ovato-lanceolate, obtusely-acuminate leaflets, with pellucid dots: and flowers, devoid of patels, arranged in compound axillary spikes. The trunk is bored about two feet from the ground; and this operation is generally performed about three times in the season: each time it produces about ten or twelve pounds of the Oleo-Resin or Balsam, as it is termed, or each tree affords about thirty-six pounds of it in the year. The juice is received into calabashes. It is, at first, very fluid and colourless, but soon thickens and assumes a straw-yellow hue. At an after period, when long exposed to the action of the air, like the essential oils, it attracts oxygen from the atmosphere, thickens, dries, and gradually changes into a solid, brittle, dry resin.

As we receive it, Copaiva has the consistence of Olive oil, is clear, transparent, of a pale straw-colour, and has a specific gravity, less than water, or 0·950; but that varies. It has a strong, peculiar, but not disagreeable odour; and a bitter, acrid, nauseous taste. It is soluble in alcohol, but remains for some time milky, on account of some insoluble matter which is joined with it, and which the French chemists regard as Animè: it is

* Woodville's Med. Bot. 3rd edit. p. 609, pl. 216. London Dispensatory, art. Copaifera. Richard, Hist. Nat. Med. t. ii, p. 506. Hayne, x, 12. Lindley, 278.

also soluble in ether, but is completely insoluble in water. When, however, it is distilled with water, an essential oil rises, and passes over, nearly equal in quantity to one-third, sometimes to half, the balsam employed. Its characters have been already described (p. 825). The resin which remains after the oil has passed over is transparent, of a greenish-brown colour, affording a smooth fracture, but has scarcely any odour or taste; and what there is, depends on its retaining, still, a small portion of the volatile oil. The resin, as already stated (p. 824), is a compound of Copaivic Acid and a viscid resin, which is left as a residue when alcohol dissolves out the acid. This viscid resin exists in the proportion of 1·65 to 2·15 per cent. in Copaiva. It is most abundant when the Copaiva has been long kept. Although the oil passes over at a heat inferior to that of boiling water, yet Scomberg, a German chemist, asserts that the Copaiva is decomposed in this process, and that both the oil and the resin are new products. This opinion, however, is erroneous; Copaiva is a compound of volatile oil and resin.

Copaiva is scarcely affected by hydrochloric* and acetic acids. Sulphuric acid, in the proportion of one part to three parts of the Copaiva, forms with it a reddish plastic mass; and this effect affords the means of detecting its admixture with castor oil, which is merely thickened by admixture with this acid: the redder, therefore, and more plastic the compound, the more free is the Copaiva from castor oil. When mixed with a larger proportion of the sulphuric acid, both the acid and the Copaiva are decomposed; a strong odour of sulphur is evolved, and yields artificial tannin. When four parts of nitric acid and one of Copaiva are mixed, and heat applied, the acid is decomposed, nitrous fumes are evolved, accompanied often with flame, and artificial tannin is produced. When united with the pure alkalies, saponaceous compounds are formed, which produce milky emulsions when mixed with pure water. Two parts of the Oleo-resin, and one part of solution of soda, or soap-boiler's ley, form a solid soap: but it attracts moisture from the atmosphere when kept. According to the analysis of Stoltze, Copaiva contains of *volatile oil*, procured by distillation, 42·6, + *adhesive brown resin* 1·7, + *brittle yellow resin* 52·7, + *brittle resin with traces of extractive* 0·75, + *volatile oil* left in water, and loss 2·69, in 100 parts.

The action of re-agents enables us to ascertain the purity of Copaiva. The simplest mode is to boil to dryness any given quantity of it in water: if it be pure, a hard, brittle resin will remain; hence the consistency of this residue determines the purity of the specimen. Another simple method is to mix two parts of Copaiva with one part of an alkaline solution, consisting

* When a stream of Hydrochloric Acid gas is driven through the volatile oil of Copaiva, artificial Camphor is formed.

of three-fourths of carbonate of potassa, and one of pure potassa: if the Copaiva be pure, after some hours the mixture divides into two parts: but if it be adulterated with one-eighth of castor oil, the whole will remain as a gelatinous mass. If four parts of Copaiva and one of carbonate of magnesia be rubbed together and left at rest, the mixture will assume an appearance not unlike solution of gum Acacia, if the Copaiva be pure; but it will be opaque, if the Copaiva be adulterated with oil.

Copaiva is a simple purgative, in moderate doses. In doses of ʒii, rubbed into an emulsion with mucilage of gum, it operates kindly on the intestinal canal, and affords great relief in hæmorrhoidal affections; both evacuating the contents of the rectum, and allaying the irritability of the inflamed surface, by lessening the determination of blood to the part. This effect may probably be in part owing to the determination which it induces to the kidneys, therefore operating as a counter-irritant. There are various methods of administering the remedy; among others, by spreading a pound of Copaiva on a dish, and sprinkling over it an ounce of calcined magnesia, then mixing it intimately, and exposing the mixture to the air for fifteen or twenty days, it acquires a consistence fit for making pills, which possess the same efficacy as the pure Copaiva. The essential oil obtained by distillation has the same properties as the Copaiva; but the resin is inert. When the Copaiva or the oil is moderately over-dosed, it sets up fever in the system, accompanied with head-ache, thirst, great heat in the bowels, and a sensation of burning in the urethra whilst passing the urine; and the kidneys are so much stimulated, that bloody urine is secreted. It sometimes brings out an eczematous eruption, which, however, soon disappears after discontinuing the use of the Copaiva. Like some other oleo-resins, these symptoms do not occur when the dose is so large as to operate at once upon the bowels. A French officer at Valladolid, in 1808, took two ounces of Copaiva for a dose; it operated as a drastic Cathartic, and cured a gonorrhœa under which he was labouring, without causing much inconvenience*.

3. Turpentines.—*Terebinthina Veneta.* E. D *T. Canadensis.* L. *Balsamum Canadense.* E. D. *T. Vulgaris.* L. D.—These Turpentines, and others closely resembling them, are, with the exception of Chian Turpentine, productions of the genus Pinus and Abies, genera of plants belonging to the natural order Coniferæ.

a. Venice Turpentine, *Terebinthina Venita,* E. D. is the production of the Abies *Larix*†, the Larch, is a native

* Revue Medicale, tome ix, p. 10.

† Woodville's Med. Bot. third edit, p. 7, pl. 4. Richard, Hist. Nat. Med. t. i p. 457. Lambert, iv. Lindley, 554.

of the European Alps, and now naturalized in this country. The Turpentine is deposited, near the centre of the tree, in minute reservoirs. It is collected by boring the tree with an auger, and putting a little wooden spout into the hole. When pure, it is thin, transparent, nearly colourless, but sometimes yellowish. Its odour is feebly terebinthinate, its taste bitterish and acrid. When distilled with water, it yields a very bland oil.

b. CANADA-BALSAM, *Terebinthina Canadensis*, L. *Balsamum Canadense*, E. D. is the production of the Abies *Canadensis*, vel Pinus *Canadensis*, the Hemlock Spruce, a native of North America. Deep incisions are made into the trunk, through which the Turpentine flows. There are two descriptions of it; one collected by incisions, the other, which is of a superior quality, by the bursting of little vesications or bladders on the bark. Both kinds are fluid, transparent, nearly colourless, with a powerful, agreeable, terebinthinate odour, and a bitter taste.

COMMON TURPENTINE, *Terebinthina vulgaris*, L. D. is procured from the Pinus *Sylvestris*, Scotch Fir*; the Pinus *maritima* yields that which comes from Bordeaux; and Pinus *palustris* and *tæda*, the Turpentine imported from America.

These three Turpentines, those officinal in the British Pharmacopœias, nearly agree in their chemical as well as in their medicinal properties. Some of them are exuded spontaneously; most of them are procured by making notches in the trunks of the trees, from which they flow; and all of them are afterwards inspissated by exposure to the air. All of them are semifluid, tenacious, semitranslucent, and exhale the same terebinthinate odour. They have a warm, pungent, bitterish taste; are inflammable; soluble in fixed oils, alcohol, and ether, affording, when distilled with water, volatile oil in combination with a small proportion of succinic acid, and a brittle resin. They all gradually solidify when exposed to the air.

These Turpentines are seldom administered as purgatives, except in the form of clysters, in which they have been found extremely serviceable in languid or torpid conditions of the intestinal canal, and in the sinking state of some febrile affections, especially erysipelas of a malignant nature. They may be exhibited in doses of from ʒi to ℥ss, rubbed up with the yolk of egg, or mucilage and sugar, and water, into emulsions. If administered by the mouth, the dose should not exceed ʒss, which may be made into pills with any bland powder, such as that of liquorice root; but, when thus given, they are more likely to operate on the kidneys than upon the bowels. In some peculiar states of the habit, and some idiosyncracies, the Turpentines are

* Woodville's Med. Bot. third edit. p. 1, pl. 1. London Dispensatory, art. Pinus. Richard, Hist. Nat. Med. t. i, p. 460. Lambert's Pin. 1. Nees Von Essen. 80. Lindley, 553.

apt to cause an eruption on the skin closely resembling eczema: in such cases their use should be discontinued.

c. RESIN.

When turpentine and some other similar products of plants are distilled, volatile oil passes over into the receiver, and a brittle, semitransparent, inodorous body, of a greater specific gravity than water, and insoluble in that fluid, remains in the retort. This is *Resin.*

Resin can never be completely freed from other substances so as to be insipid; but its sapidity depends on some distinct principle. It is soluble in alcohol, ether, the fixed oils, the volatile oils, and the alkalies. Sulphuric acid dissolves it, sulphurous acid is disengaged, and charcoal deposited: nitric acid acts upon it slowly, dissolves it, and yields a viscid matter, which, when well washed, is artificial tannin: hydrochloric and acetic acids dissolve it without changing its properties. From these facts, it is evident that resin has much affinity to the volatile oils; and as these oils, when long exposed to the atmosphere, are converted into Resin, whilst a portion of water is also formed, it is probable that the only distinction between Resin and volatile oil is that which results from the difference in the quantity of the ultimate components. According to the analysis of Gay Lussac, Thenard, and Dr. Ure, pure Resin consists of—

	Gay Lussac, Thenard.	Ure.
Oxygen	13·337	12·50
Carbon	75·944	75·00
Hydrogen	10·719	12,50
	100·00	100·00

But, from the investigations of Unverdorben*, it appears that Resin differs in its nature according to the degree of heat employed in its preparation. When the heat has been low and well regulated, it consists chiefly of *Silvic* acid, which saponifies with alkalies. When the heat has been greater, but still not very high, the resinous principle is *Pinic acid,* which is uncrystallizable and bitter to the taste; and when the heat is sufficient to empyreumatize the resin, its chief constituent is *Colophonic acid.* Resin, as it usually is procured, consists of Pinic and Silvic acid, with a neutral resin.

From this account of Resin, it is evident that, as it is insoluble in water, it is not likely to be very soluble in the salivary, gastric, and other animal secreted juices; consequently, that it can possess littte medicinal power when taken into the stomach in its pure state: but Resin, modified by other agents, becomes very active, whether the other substanees be naturally combined

* Gmelin, Handb. d. Chim. ii, 520.

with it, or added in the laboratory of the chemist. If we unite Resin artificially with an alkali, the saponaceous compound which results is stimulant, and operates upon the nerves of the intestines, increasing their peristaltic movement; while, in larger doses, it excites nausea and vomiting; thereby undeniably demonstrating its influence on the animal œconomy.

1. Jalap, *Jalapa*, L. E. D., is the tuberous root of a plant which was long regarded as a species of Convolvulus, receiving its specific name, *Jalapa*, for Xalapa, a city of Mexico, from the neighbourhood of which it was originally brought, in 1610. It was at one time supposed by Linnæus to be the root of the Marvel of Peru, Mirabilis *Jalapa;* and then that of a Convolvulus to which the specific name *Jalapa* was affixed; but both opinions are erroneous. It has been clearly ascertained to be an Ipomœa; and has had various specific names attached to it; namely, *purga**, *Jalapa*†, *officinalis*‡, and *Schiedina*§. The plant belongs to the natural order Convolvulaceæ. Dr. John Redman Coxe** obtained the plant from Mexico and cultivated it††. Schiede collected it in the mountains around Chicanquiaco, near Jalapa, on the eastern slope of the Cofre de Perote, the Mexican Andes. It grows at an elevation of six thousand feet; and on the mountains near Orizaba, within the line of frost in winter. It is a climbing plant, elegant, with hastate and cordate, acuminate leaves; and bears numerous splendid flowers, either scarlet, crimson, rose-coloured, or lilac. The tubers are gathered at any season, but chiefly in March and April, when the young shoots are appearing. They are dried by the aid of heat, in net bags, sometimes entire, sometimes cut in halves; they are exported from Vera Cruz, under the name of *Purgadi Jalapa.* Dr. Lindley supposes that the elongated tubers, slices of which are found among Jalap, are the Jalapa Macho of the Mexicans; the production of a distinct species, namely, J. *Orizabensis;* an opinion founded upon an unpublished letter from Don Juan de Orbegoze, residing at Orizaba‡‡.

The tubers of Ipomœa *Jalapa*, as they are found in commerce, are of about two or three inches in diameter, divided longitudinally, or sometimes entire, and merely notched; they seldom exceed a few ounces in weight. Sound Jalap in this state is heavy, compact, hard, breaks with a resinous fracture,

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* Nees von Essen. Wenderoth. † Hayne, Nuttal, Coxe.
‡ Pelletan. § Zuccarini.
** See American Dispensatory, 8th edit. vol. v, pl. 1 and 2. London Dispensatory, art. Jalapa. Annales du Museum. Hist. Nat. t. ii, p. 120, tab. xi. Richard, Hist. Nat. Med. t. ii, p. 120. Hayne, xii, 33-34. Lindley, 397.
†† Dr. Coxe calls it Ipomœa *Jalapa*. I am indebted to Dr. Coxe for a living specimen, which is now (November 1832) under cultivation; and I am happy in having an opportunity of publicly acknowledging his polite attention, and returning him my thanks.
‡‡ Flora Medica, p. 397.

and exhibits circular resinous veins or layers: when the slices are *white* and *friable*, the quality is inferior. The odour is heavy, and the taste sweetish and slightly acrid. It is not easily pulverised without the aid of sulphate of bitartrate of potassa, or sugar of milk. The simple powder is of a pale greyish colour. Both water and alcohol extract, separately, a part of the active principle of Jalap; but neither the alcohol nor the watery infusion act in so perfect a manner as a tincture with diluted or proof spirit, which is the proper menstruum of Jalap. When pure alcohol is employed, and the solution is boiled in animal charcoal, a resin nearly devoid of colour is obtained. This resin is soluble in oil of turpentine, ether, acetic acid, and the fixed alkalies, as if it were simple resin; yet it contains a powerful Cathartic principle, as it purges in doses of from six to ten grains. When this resin is acted on by ether, one third only is dissolved; and this, when the ether is evaporated, is soft to the touch, leaves a greasy stain on paper, and has the consistence of a plaster; the two thirds that remain undissolved have some of the characters of resin; the portion that is dissolved in ether is the active part of the Resin of Jalap.

According to the analysis of M. Cadet de Gassicourt, 100 parts of Jalap consist of resin 10·0; starch 2·5; vegetable albumen 2.5; watery extract 44·0; salts, consisting of phosphate of lime, chloride of potassium, carbonates of potassa, of lime, and of iron, and silex 3·7; woody fibre and loss 13·3, = 100*. M. Gobel found that this resin contains more oxygen than any other resin. Its constituents are—carbon 36·62, + hydrogen 9·47, + oxygen 53·91, = 100. A more recent analysis by Gerber states the resin to consist of 7·8 of *hard*, and 8·2 of *soft resin;* 17·9 *slightly acrid extractive;* 14·4 *gummy extractive;* 1·9 *uncrystallizable sugar;* 15·6 *gum;* 3·2 *Bassorin;* 3·9 *albumen;* 6·0 *fecula;* and 17·9 *water, salts, and loss* = 100·00†. The elder M. Henry analysed the three different kinds of Jalap found in the shops, and found that they all contained resin, fecula, extractive, and woody fibre; but varied considerably in the proportions of these ingredients. He found in 500 parts of

	Extract.	Resin.	Fecula.	Residue.
Sound Jalap . .	140	48	102	210
Worm-eaten Jalap.	125	72	103	200
Light Jalap . .	75	60	95	270

Thence it appears that the larvæ, which feed on the Jalap, eat the extractive part and leave the resin, the most active principle of the root; so that it is advantageous to select those tubers which are worm eaten‡. As the extractive and fecula are also

* Journ. de Parm. t. iii, p. 495. † Gmelin. Hand. d. Chim. Bot. ii, 3, 1299.
‡ Bulletin de Pharm. tome ii, page 87.

slightly purgative, it has been supposed that the combination of these with the resin is essential for the due operation of Jalap; but I am of opinion that the fecula and the extractive serve only to obtund the activity of the resin. The fecula is perhaps in larger quantity than stated in M. Cadet de Gassicourt's analysis, as it is readily detected by Iodine*.

Jalap is rarely adulterated, at least as far as regards that brought to this country; although I have seen occasionally that slices of the tubers of the Purga Macho are found mixed with it. They are paler, lighter, and more fibrous than the true Jalap. It has been said that the root of Bryonia *alba* is also sometimes mixed with Jalap; but this is very doubtful.

When administered in a moderate dose, Jalap is a certain purgative, operating without griping: in large doses, it gripes and produces copious watery evacuations. When overdosed, it excites inflammation of the intestines. Placed in contact with serous membranes, injected into the cavity either of the chest or the abdomen, it purges violently, augments greatly the hepatic secretion, and excites inflammation and gangrene, sometimes proving fatal. When united with lard, and rubbed upon the skin, it causes severe purging; but when injected into the veins, it produces no effect. Hence we may presume that it acts at least partly through the nerves. It is generally given in combination with Calomel, Bitartrate of Potassa, and other neutral salts: and, as its activity is greatly modified by the fineness of the powder, it is probable that its augmented activity in these combinations is partly owing to its minute division. It is rendered more active and deprived of its griping quality by combining it with Camphor. The watery extract, owing to the mildness of its operation, is well adapted for children. The simple resinous extract gripes violently, and exhibits all the characters of a drastic Cathartic without purging much. Combined with Bitartrate of Potassa, it operates as a hydragogue, producing thin and watery stools, whilst the deposition of fluids in the serous cavities is diminished. It is chiefly useful, as a general purgative, in febrile affections connected with an increased action of the liver and a more than natural discharge of vitiated bile into the duodenum. The powder is the best form in which it can be administered, either alone or in combination. The dose is from ten grains to half a drachm†.

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* Mr. Hume, an intelligent chemist of Long Acre, obtained a substance from Jalap by an operose process; and, regarding it as the active principle of Jalap, he named it *Jalapine*. Only five grains are obtained from an ounce of the root: it has neither taste nor odour; is scarcely soluble in either cold or hot water; and completely insoluble in ether. From the result of M. Pelletier's experiments with the Sulphate of Jalapine, sent to him by Mr. Hume, it cannot be regarded as the active principle of Jalap.

† Jalap was unknown to the Greeks and Arabians, and indeed to Europe also, until after the discovery of America.

Compound Powder of Jalap, *Pulvis Jalapæ Compositus*, L. E. D. is made by triturating together ℥iii (℥i, E. ℥viii, D.) of Jalap in powder; ℥vi (℥ii, E. lb. i, D.) of Bitartrate of Potassa; and Ginger ʒii, (L.). This is a useful hydragogue purgative. The dose is ℈i to ʒi.

Tincture of Jalap, *Tinctura Jalapæ*, L. E, D. is prepared with Jalap in powder ℥x, (℥vii, E. ℥viii, D.): Proof Spirit Oii, (Oii, old wine measure, D.), macerated for 14 (7, D.) days, and strained. The Edinburgh College orders it to be prepared also by percolation. It is used only as an adjunct to purgative draughts or mixtures. The dose is fʒi to fʒii.

Extract of Jalap. *Extractum Jalapæ.* L. E. D. The London and Dublin Colleges order lb. iiss, (lb. i, D.) of Jalap in powder; Conj. i, (seven old wine pints, D.) of Rectified Spirit; and Conj. ii, (Conj. i, D.) of water. The Jalap is to be macerated in the Spirit for four days, and the Tincture decanted. The residue is then to be boiled in the water down to Conj. ss, (Oii, old wine measure, D.), filtered and evaporated; and the Spirit distilled, until the fluids thicken. Both extracts are next to be mixed, and the whole evaporated to a due consistence.

Extract of Resin of Jalap. *Extractum* sive *Resina Jalapæ.* E.—The Jalap is ordered to be extracted by Rectified Spirit in the percolater; and, after distilling off the greater part of the spirit, the residue concentrated over the vapour bath to a due consistence.

The Resinous extract is the most active, as the aqueous portion of the other is inert, and owes its activity solely to the resin which it contains, in the proportion of 16 to 50*. The dose of the London and Dublin preparation is gr. x to ℈i: that of the Edinburgh, gr. iii to gr. vi.

Rhubarb. *Rei Radix.* L. E. D.—In the London Pharmacopœia, this root is still said to be that of the Rheum *palmatum;* and in the Dublin, it is referred also to R. *undulatum;* plants belonging to the natural order Polygonaceæ. But many doubts are still and properly entertained on this subject, and the Edinburgh College correctly mentions it as the "root of an undetermined species of Rheum." The first, the R. *undulatum*, was supposed to be the true Rhubarb; because some plants raised in Chelsea garden from seeds transmitted by Jussieu, who received them from Russia in 1702, proved them to be the R. *undulatum.* This opinion, however, was dropped in favour of the R. *palmatum*, which was first raised in the Botanic Garden of Edinburgh in 1762, from seeds sent from Petersburgh by Dr. Mounsey, as those of the true Rhubarb. But the enquiries of Pallas, and other naturalists, procured no information in favour of either of these species; on the contrary, the Bucharians who are the

* Brandes' Dictionary of Materia Medica, page 331.

dealers in Rhubarb with Russia, declared that the leaves of the *palmatum* were unknown to them*. Indeed, Pallas was diposed to regard R. *compactum* to be the species, as the leaves are said to be round and dentated. From the researches, however, of Guibourt, the root of the *palmatum*, as far as the odour and taste are concerned, approaches nearer to the true Rhubarb than that of any other species yet examined—an opinion accorded in by Dr. Pereira and Dr. Christison†; and one in which my experience of its medicinal properties lead me to coincide. Another species of Rhubarb, brought home by Dr. Hamilton from the Himalayan mountains, and described by Mr. Don under the name Rheum *Australe*, has been confidently asserted to be the true Rhubarb plant. The best account of it is given in the Transactions of the Calcutta Medical Society, by Professor Royle, who states that it is found in great quantities in the Choor mountains, in lat. 30°, at an elevation of about 9000 feet. He also states that a Mr. Gerard reports that the table land of Tartary is covered with Rhubarb, at the height of 16,000 feet; and that some very fine specimens of it were transmitted to a Captain Kennedy, from Ludak, in lat. 37°: but it does not appear that the Rheum *Australe* yields the true Chinese or Russian Rhubarb‡. Rheum *Australe* is the R. *Emodi* of Wallich: like the other species of the genus, it is an annual plant with a perennial root. It grows to the height of from six to eight feet. The whole plant is rough and beset with bristles or small points; the leaves are alternate, supported on red, deeply furrowed petioles, they are subrotundo-cordate, and of a dull green colour. The inflorescence is a loose panicle, very much resembling that of our common dock, Rumex *patientia*. There is some reason for thinking that the Rheum *compactum* yields the Rhubarb known by the name of the East Indian Rhubarb.

There are two kinds of Rhubarb known in commerce—the *Russian*, which is the best, and the *East Indian*.

Although the real species of Rheum which yields the Russian Rhubarb be still unknown, yet it is well ascertained that the root is collected in Chinese Tartary, on the hills surrounding the lake Koko Norr, and at the source of the great river Chong-cho§. But Rhubarb is collected over a considerable extent of country, it stretches from Ludak in $77\frac{1}{2}°$ east longitude to that part of the province of Shensue, called Kansu, 29 degrees farther east, and from the mountains Sue-chun, or of snow, in lat.

* For the botanical characters of Rheum *palmatum*, see Woodville's Med. Bot. third edition, p. 662, pl. 231. London Dispensatory, art. Rheum. Richard, Hist. Nat. Med. t. i, p. 508. Lindley, 358. Hayne, xii, 10.

† Dispensatory, p. 782.

‡ Transactions of the Medical Society of Calcutta, vol. iii, p. 440.

§ For the mercantile history of Rhubarb, and the method of drying it, see London Dispensatory, art. Rheum.

26° north to 33°, nearly to the borders of Siberia, 24 degrees northward; and Professor Royle informs us that the best Rhubarb is grown in the very heart of Thibet, about 96° east long. and 35° north lat. near the sources of the great Huang-ho river; but what species it is that yields it has not been ascertained*. The same pains is certainly not taken to select good Rhubarb at Canton as at Kiachta, the intermediate town between the Russian and the Chinese territories, where the Bucharians carry on their traffic with the Russians in Rhubarb†.

Good Rhubarb, of the variety named *Russian* and *Turkey*, is in flattish, irregular, angular pieces, frequently pierced with a hole large enough to admit the finger of an adult. Exteriorly, it is thinly covered with a powder of a lively yellow colour; interiorly, it is mottled with red, yellow, and gray, very irregularly, but sometimes as if radiated. It is compact, and the fracture uneven; hence it is not easily cut. Its odour is strongly aromatic; its taste slightly astringent, bitter, and peculiar; it feels gritty between the teeth; and, when chewed, tinges the saliva yellow. It is easily pulverized, and affords a powder of a bright buff-yellow colour.

Chinese or *East Indian Rhubarb*, as it is termed, is in cylindrical, irregular, but not angular, compact pieces, rounded at the edges; sometimes, but rarely, pierced with small holes, merely sufficient to pass a cord through for suspending it during its desiccation. Its colour on the exterior is of a duller yellow than that of the Russian variety, and the marbling in the interior is more of a brick red. In taste and odour it resembles the Russian Rhubarb; but it is stronger. It colours the saliva with an orange-yellow tinge, crashes more under the teeth than the Russian variety, is also heavier, and the powder is of a colour between a fawn and an orange-yellow.

What is termed *English Rhubarb* is prepared from the roots of either R. *palmatum* or *undulatum*, near Banbury in Oxfordshire. It is known by having portions of the bark adhering to it, and the texture being looser and softer than the foreign Rhubarb. It resembles the Russian in its fracture, and has a similar, but fainter odour, and a more mucilaginous taste than even the Chinese. The powder is also of a duller yellow; it is chiefly used for adulterating the powder of the foreign Rhubarb.

* Royle's Illustrations, &c. p. 315.

† Experiments have been made in Europe, particularly in France, to naturalize and cultivate Rhubarb; but every effort has hitherto failed:—a failure which cannot be certainly ascribed to the species being different from the Mongolian Rhubarb, but may depend either upon this circumstance, or upon our ignorance of the method of drying and curing the roots. The species cultivated in France for the sake of the root are R. *Rhaponticum*, and R. *compactum*. The former, and R. *hybridum*, are cultivated in this country for the leaf-stalks.

The two kinds of foreign Rhubarb described above differ in their chemical properties. Water, at 212°, takes up 24 parts in 60 of Russian, and 30 in 60 parts of East Indian Rhubarb. The infusion of the Russian is of a deeper colour and less turbid than that of the East Indian: both redden tincture of litmus, owing evidently to free rhabarbaric and oxalic acid: both are copiously precipitated on the addition of lime water to the infusion. The oxalic acid exists in the Rhubarb in the state of a binoxalate of lime*. With the infusion of Russian Rhubarb, persulphate or sesquichloride of iron strikes a dark olive colour; with that of East Indian Rhubarb a more decided green: in the former, the precipitate is slowly formed; in the latter, it is copious and sudden: solution of gelatin precipitates both, but the precipitates are of different colours. The infusions of both are, also, precipitated by potassa, soda, and ammonia; the acetates of lead, protochloride of tin, nitrate of silver, and protonitrate of mercury. Iodine, added to a cool decoction of Russian and of Chinese Rhubarb, gives an evanescent greenish-blue tinge, whilst that of English Rhubarb affords a permanent intense blue. From these effects, and those of other reagents, there is sufficient reason for concluding that these two kinds of Rhubarb are different, although this difference may arise from soil and climate, as well as from the roots belonging to distinct species of Rheum.

Many distinguished chemists have, at different periods, endeavoured to ascertain what is the active principle of Rhubarb. Scheele, and Model of Petersburgh, failed in their attempts, but ascertained that the cause of the grittiness of Rhubarb, when chewed, depends on oxalate of lime, a substance which I found in large quantity in my analysis of both kinds; and which has been detected by every one who has examined the components of Rhubarb, with the exception of Mr. Brande, who mentions neither oxalate of lime nor oxalic acid in his analysis†. When Rhubarb is sliced and boiled in water until it becomes soft, and then crushed by kneading it to a pulp in the water, pale, crystalline grains separate and subside, and are found to be oxalate of lime. My accomplished, late pupil, Mr. Quekett, obtained from 35 to 40 per cent. of these crystallized grains from Russian Rhubarb. M. Henry found the following components in both kinds of Rhubarb—1. a yellow colouring principle; 2. a bland oil; 3. amylaceous fecula; 4. gum; 5. tannin; 6. oxalate of lime, in quantity one-third the weight of the Rhubarb; 7.

* Binoxalate of potassa is found in large quantity in the stems and leaves of the Rheum *palmatum*, and the recent root of that plant. The acid in this salt was mistaken for a new acid by Mr. Henderson, who named it *Rheumic acid;* but M. Lassaigne has proved its identity with oxalic acid.

† Thomson's Ann. of Philosophy, vol xvii, p. 469.

supermalate and sulphate of lime, and salts of iron and potassa*. Other principles were found by Pfaff, M. Peretti, and M. O. Henry, Hornemann, Lucae, and Brandes; but in none of these analyses was any thing discovered which could be regarded as its purgative principle. Brandes, in his analysis, procured two per cent. of an acid which he named Rhabarberic, the constituents of which he states to be $C.^{35}$ $H.^{19}$ $O.^{19}$†; and he regarded it the active principle of Rhubarb; but six grains of it, given to a stout young man, griped, but did not purge. Pfaff, by acting with water upon the root of Rheum *palmatum*, obtained a deep-brown substance, brilliant, opaque, and bitter, which displayed no acid reaction. He called it Rhabarberin‡. Caventou obtained from the alcoholic extract a yellow crystallizable substance, insoluble in cold water, soluble in hot water, in alcohol and ether, having the odour of Rhubarb, and a sharp, bitter taste; but even this is not the purgative principle of the drug. Another principle has been obtained by treating one part of Rhubarb with eight parts of nitric acid in a gentle heat, until all action is over, and the mixture acquires the consistence of syrup; then straining and diluting with water, a precipitate falls, which is inodorous, bitter, orange-coloured, and soluble in alcohol and ether, and has been named *Rhein;* but this is not the purgative principle. It is evident, from all these analyses, that Rhubarb contains *resin, rhabarberic acid, extractive, sugar, gum, tannic acid, gallic acid, starch, pectic acid, bimalate* and *binoxalate of lime.* I am disposed to think that the purgative principle, whatever it may be, is combined intimately with the resin, as the alcoholic tincture takes up every thing active, whilst the marc that remains is altogether inert.

From the fact of Rhubarb acting on the bowels when applied to the skin, without the colouring matter appearing in the urine, it is evident that its operation is chiefly on the nerves; and it is probable that the colouring matter only passes through the kidneys, and is detected in the urine when the drug is taken into the stomach—an excellent illustration of the fact, that substances which are partially digested, and the components of which are partly carried into the circulation, may still owe their activity as remedial agents to their operation on the nervous system. When Rhubarb is taken into the stomach, its colouring matter can be detected a few hours afterwards in the urine, in the perspiration, and, if the person be a nurse, in the milk, to which it imparts colour and some degree of bitterness.

Rhubarb, as a therapeutical agent, is administered in the form of powder, infusion, and tincture. On the Continent, an alcoholic extract and a syrup are also employed. The dose of the powder should be from ℈ss to ℈i. Rhubarb in any form is a

* Bulletin de Pharm. tome vi, p. 87.

† Pharm. Cent. Blutt, 1839, § 102—5. ‡ Syst. der Mat. Med. Bot. iii, p. 30.

gentle purgative: its operation, however, is accompanied with gripings, although it rarely produces much excitement. In moderate doses, especially when administered in the form of powder, the influence of the tannic acid which it contains counteracts its purgative properties, and renders it astringent: hence, in a weakened state of the digestive organs, Rhubarb increases the appetite and affords tone to the stomach, even when the dose is sufficient to purge. It has been extolled as a vermifuge; but it is not sufficiently active to clear the intestinal canal from worms; and, therefore, it requires to be combined with more efficient purgatives for that purpose. From the mildness of its cathartic powers, it is well adapted for the diseases of infancy.

Rhubarb may be advantageously combined with calomel, jalap, scammony, and sulphate of potassa. It moderates their activity, and counteracts their tendency to lower the tone of the alimentary canal. Magnesia tends to obviate the griping property of Rhubarb; and, as most of the diseases of infants, in which purging is indicated, are accompanied with an acescent state of the stomach, it is an ordinary addition to Rhubarb in these cases. In some idiosyncracies it has caused epilepsy; and, consequently, when that occurs during its use, it should be discontinued.

The following preparations are employed as purgatives:—

INFUSION OF RHUBARB, *Infusum Rhei*, L. E. D. is prepared by macerating, for two hours, ʒiii (℥i, E. D.) of sliced (coarsely powdered, E.) Rhubarb; Oi (f℥xviii, E., f℥viii, D.) of boiling distilled water; (f℥ii spirit of Cinnamon, E.) and straining. This infusion becomes turbid on cooling, chiefly owing to the formation of tannate of starch. It is a gentle purgative, in doses of f℥i to f℥ii. It is incompatible with the mineral acids and the metallic salts.

TINCTURE OF RHUBARB AND ALOES, *Tinctura Rhei et Aloës*, E. is made with ℥iss of finely powdered Rhubarb, ʒvi of Soccotrine or East Indian Aloës, in moderately fine powder, ʒv of bruised Cardamom-seeds, and Oii of proof spirit; digested for seven days; strained, expressed strongly, and the liquors filtered. In doses of fʒiv to f℥i, it is a warm, stomachic purgative.

WINE OF RHUBARB. *Vinum Rhei*. E.—Digest ℥v of coarse powder of Rhubarb, ʒii of coarse powdered Canella, in f℥v of proof spirit, and Oii f℥xv of Sherry, for seven days; then strain, express the residue strongly, and filter the liquor. It is a purgative in doses of fʒiv to f℥i.

EXTRACT OF RHUBARB. *Extractum Rhei*. L. E. D.—The process of the London and Dublin Colleges is to digest, with a gentle heat, ℥xv (℥xii, D.) of bruised Rhubarb, in Oi (℥xvi, D.) of proof spirit, and Ovii (old wine, D.) of distilled water for fourteen days (4,D.); then to filter; let the impurities subside; pour off the clear liquor, and evaporate to a due consistence.

The Edinburgh College orders the Extract to be made with lb. i of Rhubarb cut into small fragments, and macerated for 24 hours in Oiii of water; then filtered through a cloth, and expressed with the hands or otherwise moderately; the residue is next to be macerated with Oii of fresh water for 12 hours, filtering the liquor with the same cloth as before, and expressing the residue. The liquors are then to be mixed, filtered if requisite, and evaporated, either in a water bath or in vacuo, with a gentle heat, to a proper consistence. The dose of these extracts is gr. x to ʒss.

RHUBARB PILLS, *Pilulæ Rhei*, E. are made with *nine parts* of fine powder of Rhubarb, *one part* of Acetate of Potassa, *five parts* of Conserve of Red Roses, beaten into a proper mass, and divided into five-grain pills. The deliquescent nature of the Acetate of Potassa keeps the pills from becoming hard. Each pill contains gr. iiiss of Rhubarb.

COMPOUND POWDER OF RHUBARB, *Pulvis Rhei compositus*, E. is prepared by mixing thoroughly lb. i of Magnesia, ℥ii of Ginger in fine powder, and ℥iv of finely powdered Rhubarb. It is a useful purgative in an acescent state of the stomach. Dose, for adults, ℈i to ʒss; for children, gr. v gr. x.

WATER-DOCK ROOT. *Radix Rumicis Aquatici*. D.—The Rumex *Aquaticus*, *Great Water Dock**, is an indigenous plant belonging to the natural order Polygonaceæ. It is supposed to be the Herba Britannica of the ancients, a plant noticed by Dioscorides as a specific in cutaneous diseases†.

In an analysis of the root of Rumex *acutus*, M. Deyeux found sulphur, fecula, binoxalate of lime, and vegetable albumen; and, as its medicinal properties closely resemble those of the roots of the above-mentioned species, it is likely that they contain the same principles. I have found the roots of Rumex *obtusifolius*‡ a more certain purgative than those of R. *aquaticus*.

Like rhubarb, Dock Roots are astringent or purgative, according to the extent of the dose; their colouring principle is taken into the circulation and excreted by the kidneys and the skin. Doses of f℥ii of a decoction, made with ℥i of the dried root of R. *obtusifolius* bruised, and one pint of water, purge freely, causing bilious evacuations by acting on the orifices of the gall duct in passing through the duodenum. It is prescribed with advantage in jaundice; but it is chiefly salutary in cutaneous affections, especially ichthyosis, in which it operates almost as a specific.

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* Woodville's Med. Bot. third edit. p. 658, pl. 229. Richard, Hist. Nat. Med. t. i, p. 503. Hayne, xiii, 4.

† Muntingen's Diss. Hist. Med. de Vera Herba Britannica.

‡ Lindley, 359.

d. RESINO-EXTRACTIVE.

In the present instance, Extractive is combined with Resin, and forms the chief component of a very excellent class of purgatives, the Aloetic.

The genus Aloë is an extensive one, and all the species yield a proper juice, which is more or less purgative: it belongs to the natural order Liliaceæ. The genus consists of succulent plants, with thick, firm leaves, which exhale little, but absorb powerfully by the surface*; and this function is one of great importance, as the whole family consists of plants which, growing on dry, arid soils, and in tropical climates, can imbibe little nutriment by their roots, that serve rather as props to maintain them in the erect posture, than as nutritious organs.

The secreted juice of the medicinal Aloës exudes naturally from cracks in the leaves of the plants; and, concreting upon the leaves in the form of small, transparent, granular tears, of an obscure reddish-brown colour, they are, in this state, called *lucid aloës*. But this form of Aloës is very rare, and is found only in the cabinets of Natural History. There are five kinds of Aloës used in medicine: the *Soccotrine*, the *Cape*, the *Hepatic*, the *Barbadoes*, and the *Caballine* †.

1. Soccotrine Aloes. *Aloë Soccotrina*. E. D. *Aloë*. L.—Soccotrine Aloës ‡, is the production of the Aloë *Soccotrina*, a plant which, as its name imports, is a native of the island of Zocotora, or Socotra, which was discovered by the Portuguese in 1503, and is situated in the mouth of the Red Sea, in the Arabian province of Hadramant, contiguous to Yemen; but the greater part of the best Soccotrine Aloës now comes from the kingdom of Melinda. Theodore Martius says that the Aloë *purpurasceus*, which is a native of the Cape of Good Hope, also yields Soccotrine Aloës. The plant, however, which yields most of the Aloës at the Cape, is the Aloë *spicata*. The leaves of the species from which the Aloës is procured are fluted, stiff, spreading, thick, and broad at the base, gradually tapering to a point, channelled, acute, toothed, and several feet in length. In the island of Zocotora, in Melinda, and at the Cape of Good Hope, the leaves of the plant are cut close to the stem, and the juice is allowed to run out. After remaining at rest until the feculent matter subsides, this juice is poured into flat dishes, and evaporated in the sun, or inspissated by heat. Aloës are imported in chests and casks, in skins, and in calabashes.

* When the leaf of an Aloë is separated from the plant, and left on the ground, many weeks elapse before it is shrivelled; but if it be then thrown into water, it acquires its original plumpness in a few hours.

† A sixth sort, called Clear Aloës, is never found in the market.

‡ Woodville's Med. Bot. 3rd edition, p. 767, pl. 260. London Dispensatory, art Aloës. Lindley, 594.

The real *Soccotrine Aloës* are scarce, and only occasionally imported into London, in pieces of a dark garnet-red colour, and glossy, with the thin edges and small fractured pieces reddish and semi-transparent. A specimen in my Museum is pale, semi-transparent, very friable, and is evidently the Aloës dried in the leaf which contained it. These Aloës have a peculiar aromatic odour, not unlike that of the russet apple in a state of decay, and a permanent bitter taste. They soften in the hand, and are adhesive; yet they are easily powdered, except in very warm weather. The powder has a golden yellow colour.

The *Cape Aloës* are the production of perhaps several species of Aloë, although usually referred to as *spicata*; they are of a deeper brown on the outside, are very glossy, and are softer and more pliable than the real Soccotrine. Both the exterior and the recent fracture display, on the deep brown, a greenish-yellow tint by reflected light; and the thin splinters are translucent, and have a yellowish-brown colour when viewed by transmitted light. They are friable, and afford a yellow powder, more resembling that of Gamboge than that of the true Soccotrine Aloës. If a fragment be applied to the flame of a candle, it melts, swells, and inflames.

Hepatic Aloës is the production of Aloës *vulgaris*, and some other species. Its preparation was originally confined to Barbadoes, and is still called Barbadoes Aloës (*Aloë Barbadensis*, E.); but it is now prepared in several of the West Indian islands. The juice is obtained by cutting off and draining the leaves, then boiling it down, and, when inspissated, pouring it into gourds, in which it is imported. It is also procured by boiling the chopped leaves in cloths and wicker baskets, and, after the feculencies have subsibed, inspissating the decoction.

Hepatic Aloës have a brownish-black or dark liver-colour; a dull fracture; and the splinters are nearly opaque. It is less easily pulverised than the Soccotrine or the Cape, and the powder is a less bright yellow. The colour, when the Aloës is breathed upon, resembles that of the human axilla.

Mocha Aloës is imported from Muscat, presents appearances sometimes resembling the Soccotrine, sometimes the Cape, and in others, those of Barbadoes. It is as brittle as Cape, although less than Soccotrine Aloës; and its powder has a golden-yellow tint. This kind is probably a variety of East Indian Aloës of the Edinburgh Pharmacopœia.

Caballine Aloës is a name given to the inferior kinds of Cape and Barbadoes Aloës. It is almost black, strong, empyreumatic, and fœtid; and generally mixed with many impurities.

All these Aloës are intensely bitter, and have a strong odour, increased by breathing on them. They soften by the heat of the hand; fuse in a stronger heat, and in one still higher, froth up, char, and inflame. Aloës are dissolved by cold water when

triturated in a mortar with successive portions of the fluid, and the solution becomes frothy on being agitated. When the solution is left at rest, a deposite takes place. They are entirely soluble in boiling water; but, on cooling, a resinous matter falls, which dissolves in alcohol, without leaving any residue. The portion dissolved in water contains more of the bitter principle than that dissolved in alcohol, which has little action as Aloës, until diluted to the density of 950. The true Soccotrine Aloës is dissolved entirely by this weak spirit; Cape Aloës leaves a small flocculent residue, and Barbadoes a considerable one. Tromsdorff analysed Soccotrine Aloës, and obtained 75 parts of bitter saponaceous principle, soluble in water and alcohol, but insoluble in ether, 25 parts of resin, and a trace of gallic acid, in 100 parts*. Braconnot, also, analysed this kind of Aloës. He found that the aqueous solution reddens the tincture of litmus; that the alkalies and lime-water deepen the colour, but cause no precipitation; the persulphate of iron produces a brown precipitate; the decoction of galls a yellow flocculent one, with a supernatant fluid which is less coloured than the solution, and loses some of its bitterness. He also found that the diacetate of lead, in causing a precipitation, throws down a large proportion of the colouring matter. When the aqueous solution is evaporated to dryness, it is soluble in Proof Spirit, but scarcely at all in alcohol or in ether. From these facts, Braconnot concluded that Aloës contain no *resin*; although Tromsdorff, Bouillon la Grange, Vogel, and Wicklow assert that there is a considerable proportion of it both in Soccotrine and Barbadoes Aloës, and traces of vegetable albumen. In Barbadoes Aloës, they found 52 of extractive, 42 of Resin, and 6 of vegetable albumen†. According to Tromsdorff‡, and Winkler§, who also analysed Aloës, the following are the constituents of at least two kinds of Aloës.

TROMSDORFF.	Socc.	Barb.
Saponaceous principle	75	30·25
Resin	25	6·25
Vegetable Albumen	0	12·5
Gallic Acid	trace.	trace.
	100	100·00

WINCKLER.	Socc.	Barb.
Bitter Extractive	50	60
Resin	50	35
Albumen	0	5
	100	100

The free acid is evidently the gallic, and the precipitate, by the diacetate of lead, is gum, or some principle allied to it. The fixed alkalies form saponaceous solutions with Aloës, which are precipitated by the mineral acids. Braconnot concludes that Soccotrine Aloës consists of 73 per cent. of a principle, sui generis,

* Bulletin de Pharmacie, t. i.
† Ann. de Chim. lxviii, 11.
‡ l. c.
§ Gieger, Handb. d. Pharm. Bot. ii, 782.

to which he proposed to give the name *Resino*-bitter, and 26 of a *Puce-coloured principle*, which is probably the apotheme of Berzelius*. Bouillon la Grange and Vogel analysed Soccotrine and Barbadoes Aloës, and found in the former, besides 68 parts of a soapy extractive, 32 of resin, which dissolves perfectly in alcohol, and remains long unacted upon by water, but at length communicates both colour and taste to the fluid. These chemists found also that the Soccotrine Aloës are resinified in chlorine. Both Guyton Morveau and Fabroni obtained colouring matters, all adapted for dying silk, from the recent juice of the Soccotrine Aloës.

By digesting eight parts of nitric acid on one part of Aloës until reaction ceases, and diluting the residue with water, a reddish-yellow precipitate is formed, which becomes pulverulent when washed and dried, and assumes a beautiful golden-yellow colour. This is the bitter principle of Aloës; and, according to the experiments of M. Liebeg, it consists of a peculiar substance approaching in its character to resin, and of an acid, which, from its being a compound of carbon, azote, and oxygen, is termed carbazotic. But according to Boutin, the produc's are polychromatic acid†, oxalic acid, and carbazotic acid. The washing of this principle, when evaporated, yields yellow, rhomboidal, opaque crystals, scarcely soluble in water, which are a compound of Carbazotic and oxalic acids; most probably the result of the action of the nitric acid on the extractive of the Aloës. The bitter principle of Aloës requires 100 parts of cold water for its solution. It is more soluble in hot water. With both it forms a beautiful claret-purple solution, which, when boiled with silk, communicates to it a permanent colour, that neither soap nor any other substance affects, except nitric acid, which changes it to yellow; but it again assumes its proper colour when washed with water. By the aid of mordants, it dyes flannel of a beautiful black, which is not altered by light. With potassa, this bitter principle forms a purple salt, which precipitates the salts of baryta, those of lead, and the peroxide of iron, of a deep purple hue, and the protonitrate of mercury of a deep red: forming polychromatates of these bases.

When the Soccotrine Aloës are distilled, a volatile oil is obtained, which is not procured from the Barbadoes Aloës: it is this oil that gives the peculiar odour to the Soccotrine Aloës.

Aloës is a warm, stimulating purgative, which exerts very little, if any, action on the duodenum and small intestines, but affects the colon, and especially the rectum, evacuating the latter fully, yet without causing watery stools. This peculiarity in the operation of Aloës has been referred to its little solubility

* Journ. de Physique, lxxxiv, 334.

† This acid, according to Pelouze, is a compound of $C.^{15}\ H.^{5}\ N.^{2}\ O.^{13}$ equiv. = 226·90.

in the fluids of the intestinal canal, permitting it to pass nearly through the whole length of the canal before it is sufficiently dissolved to exert its stimulant effect. But those who reason in this manner have forgotten that Aloës, when applied to an ulcer on the neck, acts on the rectum. In whatever manner the effect is to be explained, this fact is undoubted. All the kinds of Aloës exert the same medicinal influence. The ancients employed an Aloës resembling the Barbadoes Aloës, being the production of A. *vulgaris;* and used it both internally and externally. As an internal medicine, they regarded it less hurtful than any other purgative, "ideoque," says Celsus, "omnibus Catharticus Aloë miscenda est." They applied it to ulcers and wounds, combined with other medicines; and as a lotion in some species of ophthalmia, a practice which is at this day followed by the Tamool physicians in India, who also use it, toasted, in some bowel complaints of puerperal women. When Aloës are administered in moderate doses, the functions of the digestive organs are improved; but when these are labouring under excitement, when the tongue is dry, and there is thirst, heat, and pain in the abdomen, then their employment should be intermitted. They are said to act equally well in small and large doses; but this assertion does not accord with my experience. The usual dose of Aloës is from five to ten grains; a dose which does not require to be increased, even under the daily custom of taking the medicine to relieve habitual costiveness. In such cases, and in the costiveness of dyspeptics, particularly those of sedentary and hypochondriacal habits, the intestines require a stimulus, being generally in a sluggish and insensible state; consequently Aloës is a very useful evacuant, as it is a warm and stimulant medicine, and does not produce flatulence. It has been thought peculiarly well adapted for cases of jaundice, on the supposition that it may supply, to a certain extent, the bitter of the bile which is deficient. It is certainly useful in obstructions of the biliary duct; but in such cases it requires the combination of alkalies, and of calomel or the blue pill, to stimulate the orifices of that duct, which is little affected by the Aloës alone in its passage through the duodenum. Dr. Cullen*, nevertheless, asserts that nothing is gained by combining Aloës with other substances; but this opinion is at variance with the results of experience: no medicine is more modified by combination than Aloës. When combined with soap or an alkaline salt, it operates more quickly, and with less violence and considerably less irritation on the rectum, than when uncombined. Its action is also modified when it is combined with scammony, colocynth, aromatics, salts of iron, myrrh, and fœtid gum-resins. One of the best forms of combination,

* Materia Medica.

when it is desirable to improve the power of the digestive organs, and at the same time open the bowels, without the usual griping and action on Hæmorrhoids caused by Aloës, is the following:

℞ Myrrhæ ʒvi
Sodæ Subcarbonatis ℥iii
Ammoniæ ʒivss
Aloës extracti ʒvi
Vini albi (Anglice, Sherry) f℥xxiv.
Macera per dies septem et cola.

Two table-spoonfuls may be taken twice a day, in a fluid ounce of a solution of extract of liquorice.

From the peculiar action of Aloës on the rectum, they are supposed to be contraindicated in hæmorrhoids and in pregnancy. In the former, if the dose be small, I have never seen any increase of the pain nor irritation excited; and many of the numerous nostrums, under the name of dinner pills, into which Aloës enters, are daily taken with impunity by those liable to piles. It is not necessary, however, to order Aloës to patients labouring under hæmorrhoids, in the face of a prevailing opinion; but, when other circumstances indicate their use, we need not be prevented from ordering them. In the same manner Aloetics are generally condemned in pregnancy; but Dr. Denman has remarked that "they are in common use among the lower classes of persons, because they are cheap and conveniently given in the form of pills*;" and no bad effects are observed to follow their use. Aloës, however, ought not to be administered during the menstrual discharge; nor in those cases in which there is much uterine irritation, and a tendency to larger and more frequent discharges from the uterus than is natural.

Aloës enters into numerous officinal preparations; and, in almost every form, they constitute a valuable purgative.

3. COMPOUND DECOCTION OF ALOES, *Decoctum Aloës compositum*, L. D DECOCTION OF ALOES, *Decoctum Aloës*, E. is prepared by boiling Extract of Liquorice ʒvii (℥ss, E.), Carbonate of Potassa ʒi (℈ii, E.) Soccotrine (or Hepatic, E. D.) Aloës in powder, Myrrh in powder, Saffron, of each, ʒiss (ʒi, E.) in Oiss (f℥xvi, E.) of distilled water to Oi (f℥xii, E.), then straining, and adding f℥vii (f℥iv, E.) of Compound Tincture of Cardamoms.

Dose, f℥ss to f℥ii. It is an excellent warm purgative.

1. PURIFIED EXTRACT OF ALOES. *Extractum Aloës purificatum.* L.—Macerate ℥xv of Aloës bruised, in Conj. i of boiling water, for three days, with a gentle heat; and after the impurities have subsided, decant and evaporate the clear liquor, stirring near the close, till it acquire a consistence for pills.

2. EXTRACT OF HEPATIC ALOES. *Extractum Aloës Hepaticæ.*

* Introduction to the Practice of Midwifery.

D.—Boil to one half *one part* of Hepatic Aloës in *eight parts* of boiling water, filter, and concentrate at 200° or 212°, till the liquid thickens, and then evaporate over the vapour bath, with frequent stirring, to a consistence for pills.

4. PILLS OF ALOES. *Pilulæ Aloës*. E. Beat into a proper pill mass *equal parts* of Aloës and Castile soap with a sufficiency of Conserve of Roses.

5. COMPOUND PILLS OF ALOES. *Pilulæ Aloës compositum*. L. D. Beat together into a uniform mass for pills ℥i of Soccotrine (Hepatic, D.) Aloës in powder; ℥ss of Extract of Gentian; m. xii of Oil of Carraway, and a sufficiency of simple syrup. The syrup, as Dr. Pereira properly remarks, is unnecessary.

Dose, gr. v to gr. xv; a useful purgative in habitual costiveness.

PILLS OF ALOES AND ASSAFŒTIDA, *Pilulæ Aloës et Assafœtida*, E. are made with Soccotrine or East Indian Aloës, Assafœtida, and Castile soap, of each *equal parts*, beat into a pill mass with Conserve of red Roses.

The dose is gr. x to ℈i. A useful pill in torpid states of the bowels in hysterical and dyspeptic individuals.

PILLS OF ALOES AND MYRRH. *Pilulæ Aloës et Myrrhæ*. L. E. D. —The London and Dublin Colleges order ℥ii of Aloes (Hepatic, D.) ℥i of Myrrh, ℥i of Saffron, and a sufficiency of Syrup, to be beaten into a uniform mass. The Edinburgh formula is *four parts* of Soccotrine, or East Indian Aloes, *two parts* of Myrrh, and *one part* of Saffron, beaten into a pill mass, with a sufficiency of Conserve of Roses.

PILLS OF ALOES AND IRON. *Pilulæ Aloës et Ferri*. E.—Take of Sulphate of Iron *three parts;* Barbadoes Aloës, *two parts;* Aromatic powder, *six parts;* Conserve of Red Roses, *eight parts;* Pulverize the Aloës and Sulphate of Iron separately; mix the whole ingredients, and beat them into a proper mass, which is to be divided into five-grain pills.

COMPOUND POWDER OF ALOES. *Pulvis Aloes compositus*. L.—Pulverize, separately, ℥iss of Aloës and ℥i of Guiaicum, and mix the powders with ℥ss of compound Cinnamon powder.

Dose, gr. x to ℈i. The Guiaic does not prevent the purgative action of the Aloës, but adds to it a sudorific effect.

POWDER OF ALOES WITH CANELLA. *Pulvi Aloës cum Canella*. D.—Powder separately and mix lb. i of Hepatic Aloës and ℥iii of Canella.

Dose, gr. x to ℈i. This is the old officinal Hiera Piera.

TINCTURE OF ALOES. *Tinctura Aloës*. L. E. D —The process for this Tincture is distinct in each of the British Pharmacopœias. The London College orders ℥i of bruised Aloës, ℥iii of Extract of Liquorice, Oiss of Distilled Water, and Oss of Rectified Spirit, to be macerated for 14 days and filtered.

The Edinburgh College directs ℥i of Soccotrine or East Indian Aloës coarsely powdered, ℥iii of Extract of Liquorice, f℥xii of Rectified Spirit, and f℥xxviii of Water, to be mixed, and digested, with occasional agitation, for seven days, and the clear liquor filtered.

The formula of the Dublin Pharmacopœia is to dissolve ℥iss of

Extract of Liquorice in ℥viii of boiling water, then to add ℥ss of powdered Soccotrine Aloës and f℥viii of Proof Spirit, digest for seven days and filter.

Dose, f℈ii to f℥i. It is a warm stomachic purgative.

COMPOUND TINCTURE OF ALOES. *Tinctura Aloës composita.* L. D. *Tinctura Aloës et Myrrh.* E.—Take of Aloës (Soccotrine, E. D. or East Indian, E.) in coarse powder ℥iv (℥iii, D.); saffron (none, D.), ℥ii; Tincture of Myrrh Oii (f℥xvi, D.), macerate for fourteen (seven, E.) days and filter.

WINE OF ALOES. *Vinum Aloës.* L. E. D.—The London and Dublin Colleges order of powdered Aloës ℥ii (℥iv, D.), bruised Canella ʒiv (℥i, D.), sherry Oii (Oiii, D.), (and proof spirit Oi, D.) to be macerated for 14 days and strained. The Edinburgh process is to digest ℥iss of Soccotrine or East Indian Aloës, ʒiss each of coarse powdered Cardamom seeds and Ginger, in Oii of sherry for seven days, and to strain through linen or calico.

Dose, fʒiv to f℥ii. It is a warm purgative.

It is usually stated, that, owing to their bitter, nauseous taste, pill is the best form of exhibiting Aloës; but I know of no medicine that is so soon reconciled to the palate, even of children, as the above preparation, especially that with the alkalies and the wine which I have described, when it is given in a solution of the extract of liquorice The dose of simple Aloës is from three to sixteen grains; but, if taken daily, it should not exceed six grains: in larger doses, if the use of the medicine be continued for some days, it is apt to induce piles and tenesmus.

c. CATHARTIN.

This principle was discovered by MM. Lassaigne and Feneulle in Alexandrian Senna*, in which it is combined with extractive, mucilage, fixed oil, a trace of volatile oil, albumen, and other vegetable constituents. It is uncrystallizable, of a reddish-yellow colour, has a peculiar odour, and a bitter, nauseous taste. It is soluble in alcohol and in water in every proportion, attracting moisture from the atmosphere: it is insoluble in ether. Heat decomposes and resolves it into carbonic acid, acetic acid, hydrogen gas, empyreumatic oil, and charcoal. The solution of Cathartin is precipitated by infusion of galls in yellow floculi; the diacetate of lead also precipitates it; but the acetate does not affect it. The alkalies and the sesquisulphate of iron deepen the colour of the solution, but do not throw down precipitates in it: chlorine decolorizes its solution. Dr. Christison, with some justice, doubts whether it is the active principle of Senna†.

SENNA LEAVES, *Senna,* L. D. *Senna Alexandrina,* E. *Senna*

* Ann. de Chimie et de Phys. t. xvi.

† Dispensatory, p. 850.

Indica, E. are the production of several species of *Cassia*, a genus of plants belonging to the natural order Leguminosæ*: But four species are particularly pointed out as supplying the Senna of commerce; namely, S. *acutifolia*, S. *Lanceolata*, S. *obtusata*, and S. *obovata*. The first,

Cassia *acutifolia*, of Delile and Richard, is a small plant, which grows abundantly in Upper Egypt, near Syene in Nubia, where it is called *Abyreyga;* in Sennaar, and at Bornou in Central Africa. Its leaves are alternate, accompanied with two awl-shaped stipulæ at their base, and consist of from four to eight pair of opposite, oblong, acute, entire, nearly sessile leaflets: the flowers are yellow, in axillary, pedunculated spikes; the fruit is an elliptical, broad, obtuse, not curved legume, containing many heart-shaped seeds. The leaflets form a small part of the true Alexandrian Senna. The Alexandrian Senna, however, as we receive it, is a mixture of the leaflets of Cassia *lanceolata*, C. *obtusata*, the footstalks of the leaves, and the pods of these plants; with an admixture of leaflets with which the Senna is adulterated at Alexandria; namely, those of the Cassia *obovata*, those of the Cynanchum *oleæfolium*, or *Arghuel*, and occasionally those of the Colutea *arborescens*, or Bladder Senna; and a few leaflets and pods of Tephrosia *apollinea*. Rouillere and Dr. Callodon inform us that Alexandrian Senna is compounded at Boulac of the following leaflets: five parts of Cassia *acutifolia;* three parts of Cassia *obovata;* and two parts of the leaves of Cynanchum *oleæfolium*, or Arghuel, a plant belonging to the Apocyneæ. The leaflets of C. *acutifolia* (see fig. 1, p. 896,) seldom exceeds nine lines in length, is oblique at the base, and unequal on each side of the midrib, *a*, *b*, pointed and veined on the under side. The leaflets of the Cassia *obovata* (fig. 2) are, as the name of the plant implies, obovate, obtuse, with a minute point, *c*, which is the prolongation of the mid rib; unequal, and somewhat cuneiform at the base, *a*, *b*, and slightly pubescent. The leaves of the Cynanchum (fig. 3), or Arghuel are an inch or fourteen lines in length, pointed, equal at the base, but with one side, *b*, straighter than the other, *a*, and without any lateral nerves on the under disk. The best specimens of Alexandrian Senna are those which contain the fewest leaf-stalks and pods, and the smallest quantity of Arghuel and Tephrosia. The odour of Alexandrian Senna is disagreeable; it has a greyish-green colour. When the pods are removed, it is called Picked Senna.

The Senna known by the name of *Tripoli Senna*, consists probably also of the Nubian Senna, the Cassia *acutifolia;* the

* Woodville's Med. Bot. 3rd edition, p. 442, pl. 159. London Dispensatory, art. Senna. Richard, Hist. Nat. Med. t. ii, p. 518. Hayne, ix, 41, 42. Lindley, 258.

leaflets are smaller than those of the Alexandrian Senna, and more broken; but they are usually free from any admixture either of pods or the leaflets of C. *obovata,* or those of Arghuel.

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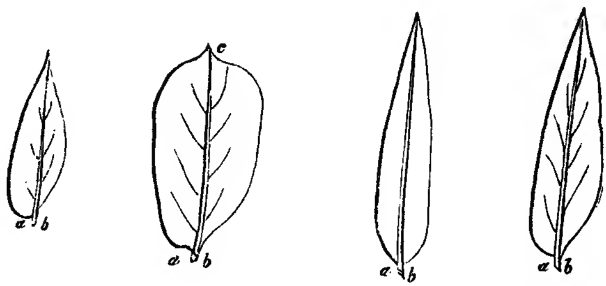


The C. *oborata* is a smaller plant than the C. *acutifolia:* it is a native of Syria, Egypt, and Senegal. I have already described the form of the leaflet: the pod is curved. It constitutes the Senna known by the name of Aleppo Senna, which is rarely brought to this country, unless in mixture, as I have already stated, with Alexandrian Senna.

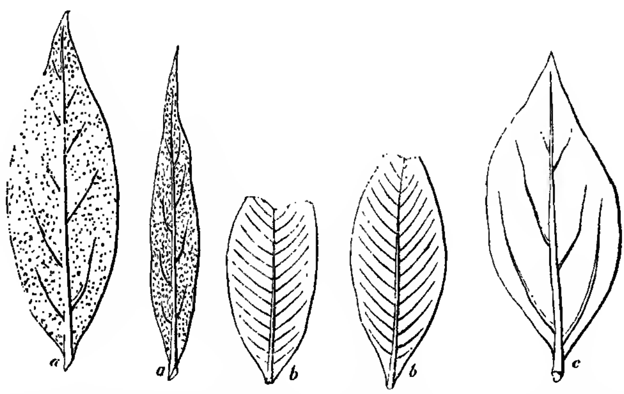
The third species of Senna, the Cassia *lanceolata* of Forskahl, is known in this country by the name of *East Indian Senna,* although it is not a production of India, but grows at Abuarish, in Arabia Felix, and was formerly exported from Mocha. Its leaflet (fig. 4) is upwards of an inch in length, and unequal at the base, *a, b.* It is known in the Indian bazaars by the name of Sena Mekki. It resembles the next kind of Senna, the Tinnivelly, but differs from it in being mixed with stalks and pods.

Tinnivelly Senna is cultivated on the Malabar coast: it is imported in large quantity into this country under the name of *Timnivelly* or *Fine East Indian Senna,* and fetches a high price in the London market. It contains neither stalks nor pods. It is evidently a variety of the C. *lanceolata,* modified by culture. It is milder in its operation than the Alexandrian drug; is as certain a purgative, and operates without griping. It has not, however, been adopted into general use in Great Britain. Cassia *Marilandica,* a plant found over all the United States, seems to be another variety of the C. *lanceolata.* It differs from the C. *acutifolia* and the C. *obovata,* in having glands at the base of the petioles of the leaflets, and by the smoothness and length of the leaflets, which are nearly two inches long, straight, and almost subulate.

Senna is collected twice a year, by the Arabs of the tribe of Abaddeh; one, after the rains in August and September, the other about the middle of March. It is gathered in the Vale of

Bicharié, near Syène. The plants are cut down and dried in the sun; the leaflets are then separated, packed in bales of date leaves, and sent to Boulac, where the admixture which I have described is said to take place. The quantity of Senna sent to Boulac is about two millions of pounds, and nearly double that quantity is imported into Europe. The first entrepôts for Senna are Assouan, Esneh, Keneh, and Duraôu, whence they are conveyed to Boulac. The whole Senna from these parts amounts from about 13·500 to 15,300 quintals*.

The following are the adulterations in Senna, as imported into this country, independent of the pods and stalks of the various species of Cassia. The most important and the most abundant are the leaves Cynanchum *Arghuel* (*a a*), a plant growing in Nubia, belonging to the natural order Asilepiadaceæ. Its leaves are easily distinguished from the leaflets of Senna by their ovato-lanceolate acute form, their thickness, stiffness, and somewhat warty surface, and their pale glaucous colour. They have an intense bitter taste, and gripe violently. The leaflets of Tephrosia *Apollinea* (*b b*) are less abundant. This plant is a native of Nubia, in the natural order Leguminosæ. The leaves are ovato-oblong, marginate, with parallel transverse veins, and silky on the under-side; the pods are long, narrow, slightly curved, and six to seven seeded. On the Continent, the leaves of Bladder Senna, Colutea *arborescens* and Coriaria *myrtifolia*†, are also found in Senna; but I have never seen them in that which has been brought to this country.



Senna leaves, as the leaflets are termed, have a faint, sickly, disagreeable odour, and a slightly bitter, aromatic, sweetish taste, very nauseous to the palate of most people. Besides Cathartin and Extractive, analysis has discovered in them—1, a *fat oil;* 2, a *fixed* and *volatile oil;* 3, *albumen;* 4, a *yellow colouring prin-*

* Pereira's Elements of Mat. Med. page 1601.
† Delile Des. de l'Egypte, tome xx, page 2. Lindley, 543.

ciple ; 5, *mucilage ;* 6, *malic acid ;* 7, *malate and tartrate of lime ;* 8, *acetate* and *sulphate of potassa* and *chlorophille*, or the green colouring matter of plants*. Water at 96°, if allowed to stand on the leaflets for twenty-four hours, takes up all the active parts of Senna, without the griping matter, which is dissolved in boiling water. When Senna is boiled, the volatile principles are dissipated, the extractive is oxidized, and probably some change takes place in the resinous principle which causes griping. Various reagents affect the infusion. Oxalate of ammonia detects the presence of salts of lime ; nitrate of silver and corrosive sublimate, that of albumen. The infusion should not be kept ready made, as the extractive becomes oxidized and the cathartin decomposed ; and the medicine is thus rendered inert as a purgative, but gripes violently. When the infusion is shaken in chlorine gas, the extractive combines with the chlorine, forming a compound, which is insoluble in water, but soluble in alcohol, the mineral alkalies, and in ether, thereby indicating its approximation to resin. If the infusion with hot water have a pale yellow colour and an astringent taste ; if gelatine throw down a white precipitate ; and the precipitate by corrosive sublimate and emetic tartar be great ; if sulphate of iron produce a blue precipitate ; and nitrate of silver a black ; whilst, at the same time, the nitromuriate of gold produces an instantaneous black ; or caustic potassa a gelatinous precipitate ; M. Guibourt has ascertained that these appearances indicate an adulteration with the leaves of the Coriaria *myrtifolia*.

Senna is a useful and very general purgative, there being scarcely any disease in which it cannot be administered. The following are the forms in which it is prescribed.

COMPOUND INFUSION OF SENNA, *Infusum Sennæ compositum*, L. D. *Infusum Sennæ*, E. is made by infusing, for four hours (one hour, E.), in a light, covered vessel, ʒxv (℥iss, E. ℥i D.) of Senna ; ℈iv (ʒi D.) of ginger, in Oi (f℥xvi, D.) of boiling distilled water, and straining (through linen or calico, E.). This infusion is the best form of administering the medicine ; but it should be made with tepid water. The nauseous taste, so disagreeable to many, is said, by Dr. Paris†, to be covered by infusion of Bohea tea ; milk and sugar being added in the same proportions as in common tea. The purgative property of the infusion is increased by the addition of camphor mixture, or the decoction of guaiacum. The infusion is seldom given alone ; but the incompatibles should be well known to the prescriber, as some of them are in common use—such, for example, as magnesia, rhubarb, and the carbonates of the alkalies, which destroy the properties of the Senna. The griping quality of the drug renders

Journ. de Pharm. tome vii, page 548. † Pharmacologia.

an aromatic necessary, when the nature of the disease does not forbid its employment. The dose of the infusion is from f℥ss to f℥iv.

COMPOUND INFUSION OF SENNA, *Infusum Sennæ compositum*, E. *Infusum Sennæ cum Tamarindis*, D. is prepared with ʒi of Senna; ℥i of Tamarinds; ʒi of bruised Coriander; ℥ss of Muscovado (℥i, D.) and f℥viii of boiling water, infused for four hours, with occasional stirring, in a covered vessel not glazed with lead, and then strained through calico or linen. Except in point of taste, this infusion possesses no advantage over the former. The dose is f℥ii to f℥iv.

SYRUP OF SENNA. *Syrupus Sennæ.* L. E.—By the London formula, ℥iss of Senna, ʒx of bruised Fennel, are to be macerated in a gentle heat in Oi of boiling water, the liquor strained, and, after being mixed with ℥iii of Manna and ℥xv of Sugar, boiled down to a proper consistence. The Edinburgh College orders ℥iv of Senna to be infused for twelve hours in f℥xxiv of boiling water, then strained and strongly expressed through calico, so as to obtain Oi f℥ii of liquid; next concentrate ℥xviii of Treacle in the vapour bath as far as possible, or till a little taken out on a reed becomes nearly concrete on cooling; and, whilst it is hot, add the infusion, stirring carefully, and removing the vessel from the vapour bath as soon as the mixture is completed. The syrup is a bad form of Senna, but the powder is worse, although it continues to hold a place in the Pharmacopœia of the London College. The dose of the syrup is ʒi to ʒiii for children.

COMPOUND TINCTURE OF SENNA. *Tinctura Sennæ composita.* L. E. D.—The London and Dublin Pharmacopœias order ℥iiiss (lb. i, D.) of Senna; ʒiiiss (℥iss, D.) of bruised Carraway; ʒi (℥i, D.) of Cardamoms, bruised; ℥v (none, D.) of Raisins, and Oii (conj. i, D.) to be macerated for fourteen days and strained. The Edinburgh College orders ℥iiss of Sugar, ℥i of bruised Cardamoms, ʒvi of Jalap in powder, ʒv each of Carraway bruised and Cardamom seeds bruised, ℥iv each of bruised Raisins and Senna, to be digested in Oii of Proof Spirit for seven days, then strongly expressed and filtered; or the Tincture may be made by percolation. This tincture is a good form of preparation of Senna to combine with the infusion; but the raisins ordered in the London formula are useless, and have been judiciously left out in the Dublin Pharmacopœia. The dose is f ʒii to f℥i: it is seldom prescribed alone as a purgative.

CONFECTION OF SENNA. *Confectio Sennæ.* L.—*Electuarium Sennæ.* E. D.—According to the London and Edinburgh Colleges, the heterogeneous compound is to be made with ℥viii of Senna, lb. i of Figs, lb. ss (lb. i, E.) each of Tamarind (none, E.), Cassia pulp (none, E.), and Prunes, ℥iv Coriander, ℥iii of Liquorice, lb.iiss of Sugar, and Oiii (Oiiss, E.) of water. The Senna is to be

rubbed with the Coriander, and ℥x of the mixed powder separated by a sieve. Boil the water, with the figs and the liquorice added, to one-half; then press out the liquor and strain it. Evaporate the fluid in a water-bath until, of the whole, f℥xxiv remain, then add the sugar and make a syrup. Lastly, rub the pulps gradually with the syrup, and, having thrown in the sifted powder, mix the whole. The Dublin College orders ℥iv of finely powdered Senna, lb. i of Prunes, ℥ii of Tamarind-pulp, Oiss of Syrup of Raw Sugar, and ℨii of oil of Carraway. The pulps to be boiled in the Syrup to the consistence of honey, and then the powder to be added, and, when the mixture has cooled, the oil. The whole is to be thoroughly mixed. The dose is ℨi to ℨvi. The confections or electuaries into which Senna enters are so compounded of other purgative substances, that it is difficult to say what part the Senna acts in these preparations.

* * INORGANIC SUBSTANCES OPERATING AS PURGATIVES.

a. METALLIC OXIDES.

The only Metallic Oxides which are employed as purgatives are the protoxide of mercury, and a combination of mercury and oxygen which approaches to the state of the protoxide, the Hydrargyrum cum Magnesia of the British Colleges. I am aware that the nature of the latter is regarded as problematical; but my reasons for considering the mercury in it a protoxide remain unaltered.

1. THE MERCURIAL, OR BLUE PILL, *Pilula Hydrargyri*, L. E. D.—is made by rubbing ℨii (two *parts*, E.) of Mercury with ℨiii (three *parts*, E.) of Confection of Red Roses, until globules can be no longer seen, then adding ℨi (one part, E.) of Liquorice root in powder (Extract Liquorice, reduced to fine powder, D.), beat the whole until well incorporated. In this pill the oxide of mercury is probably formed by the large surface of the metal exposed in triturating with the vegetable matter. It purges in some cases in any dose; but in such instances its activity depends either on some peculiarity of habit or idiosyncracy; or on an acescent state of the stomach, in which the hydrochloric acid of the gastric fluid probably gives the pill activity. It is seldom trusted to as a purgative: it is given in moderate doses at bed-time, and carried off by a purgative in the morning, according to the plan pursued by Mr. Abernethy. It is most useful in diseases connected with a diminished secretion of bile.

2. MERCURY WITH MAGNESIA. *Hydrargyrum c. Magnesia.* D.—In this preparation, the Mercury, although it is generally stated that the metal is merely mechanically divided, yet the presumption is strong in favour of its oxidizement. I cannot

conceive any action to result from Metallic Mercury, however divided, equivalent to that which this preparation displays. It is very mild in its operation, and is seldom employed, except in cases where an alterative is required; or as a purgative for children, in whom there is much acidity of stomach, and at the same time some glandular obstruction. In such cases it is a useful purgative. The dose is gr.v to ℈i.

b. CHLORIDES.

These are combinations of chlorine and metallic bases.

1. CHLORIDE OF SODIUM. *Sodii Chloridum.* L. *Sodæ Murias.* E. D. *Soda Murias purum.* D.—The nature of this salt has been already examined under the head of Tonics (p. 191); but, as it operates also as a purgative, particularly as it exists in sea water, it is again necessary to direct attention to it. Sea water has been examined by different chemists; amd although its constituents are found to be the same wherever it is taken up, yet the quantities of these differ greatly according to the part of the ocean, its distance from land, and the depth at which it is procured. It was also demonstrated, by Dr. John Murray, that the salts obtained from sea water differ according to the mode in which the water is analysed. Its specific gravity is 1·0269 to 1·0285; and it requires a temperature nearly four degrees under the freezing point, or 28·5° Faht. to freeze it. The average quantity of saline matter in it is about three and a half per cent. and consists of Chloride of Sodium, Chloride of Potassium, Chloride of Magnesium, Bromide of Magnesium, sulphate of magnesia, sulphate of lime, carbonate of lime, and some iodic salt in minute quantity. The active purgative principle is undoubtedly the common salt, or Chloride of Sodium, and the Chloride of Magnesium.

Sea water has a bitter, saline taste. When taken into the stomach in doses of half a pint, repeated twice or three times at the interval of half an hour, it operates as a mild but very effectual purgative; and from its continued use in this quantity, for some weeks successively, very beneficial effects have been produced, with less reduction of strength than follows the continued use of any other purgative. It has been successfully employed as a vermifuge, particularly when the worms are the ascarides, or thread worms; and in this case it has the advantage of giving tone to the system, whilst it clears the canal of the worms already existing in it. Sea water has been frequently taken, with advantage, in habitual costiveness, particularly by individuals of full habits who lead a sedentary life. In these instances its stimulant properties are as useful as its purgative qualities. When it is to be given to children, they are easily

persuaded to take the dose, if its nauseous taste be covered with a little port wine. It is a curious fact, that by the continued employment of sea water as a purgative, although for a short time it produces emaciation, yet its secondary effect is to promote obesity, which must be attributed to its stimulant properties, acting on the glandular system, and thus increasing the powers both of the digestive and the assimilating functions. Although the Chloride of Sodium is undoubtedly the most active ingredient of sea water, yet it is true that the solution of this salt does not possess the same purgative qualities as sea water, nor can any artificial admixture of its components, in the average proportions in which they have been found by the best chemists, produce a compound of powers equivalent to those of natural sea water. It is not easy to account for this fact; but it has prevented the employment of artificial sea water, even to the extent that artificial mineral waters have been used. In cases of ascarides, sea water is most efficacious when exhibited in the form of enema.

Although sea water connot be regarded as a purgative of much power, yet in some constitutions it operates when no other Cathartic will take effect. This is to be attributed to idiosyncracy; but it is a fact, the knowledge of which is of great practical importance. When sea water fails to purge, which it does in some habits, it produces fever of a low kind, accompanied with purple spots on the skin: this, however, cannot be attributed to the Chloride of Sodium alone; since, as I have already stated, sulphate of magnesia and of lime, and chloride of magnesia and of lime, all of which are purgative, are also components of sea water.

2. Chloride of Mercury. *Hydrargyri Chloridum.* L. *Calomelas.* E. *Calomelas sublimatum.* D. *Calomelas precipitatum.* D. (p. 162.)—When intended to operate as a purgative, Calomel should be given in much larger doses than are usually prescribed; since, in such doses only, it allays the irritability of both the stomach and the bowels*. Mr. Annesley, in his work on the Diseases in India, remarks that "Calomel in large doses combines with and renders fluid, and detaches, the viscid, mucous secretions adhering to the alimentary canal; it diminishes the vascular state of the stomach when this is in excess; and increases the vascular and capillary circulation in the mucous coat of the large intestines†." The operation of Calomel, however, as a purgative, is very uncertain; and it should always be followed by another brisk purgative, to prevent its action on the glandular

* Dr. Pereira informs us that Mr. Charles Bennett gave it in cases of Asiatic Cholera, in a dose at first of ʒii, and afterwards ʒi every hour or two hours, with little physiological effects.—Elements of Mat. Med. 2nd edit. vol. i, p. 743.

† Diseases of India.

system, when that is not the object of its administration. It may be regarded as operating beneficially when the secretions are improved without any effect being induced on the salivary glands. Experience informs us that, during the administration of Calomel, the appearance of the evacuations is rarely natural, being either greenish or slimy, and inodorous or fœtid: in more than one instance I have seen them clay-coloured. During a course of Calomel, therefore, as a purgative, the medicine should be frequently intermitted for a few days, to ascertain the real state of the contents of the intestines when the stimulant is withdrawn. Like every other active remedy, it proves useful or otherwise, according to the manner of prescribing it and the condition of the habit of the patient at the time. The usual dose is gr. iii to gr. vi.

COMPOUND PILLS OF CHLORIDE OF MERCURY. *Pilulæ Hydrargyri-Chloridi compositæ*. L. *Pilulæ Calomelanos compositæ*, E. D. Syn. *Plummer's Pill*. The London Pharmacopeia orders ʒii each of Chloride of Mercury and Oxy-Sulphuret of Antimony to be triturated together, adding, during the process, ℥ss of powdered Guaiac and ʒii of treacle, until a uniform mass is obtained. The Edinburgh and Dublin direct *one part* each of Calomel and Golden Sulphuret of Antimony, and *two parts* of Guaiac in fine powder, to be mixed and beaten into a proper pill mass with *two parts* (a sufficiency, D.) of treacle: to be divided into six-grain pills. The dose, as a purgative, is gr. x to ℈i.

c. SALTS.

1. SULPHATE OF MAGNESIA. *Magnesiæ Sulphas*. L. E. D. Sulphate of Magnesia is found ready formed in many mineral waters, and was first prepared by the evaporation of those of Epsom in 1694; hence its name *Epsom salts*. It was also procured from the water of Seidlitz and various other mineral springs. A large proportion of what is now used is manufactured from bittern, the mother ley remaining after the crystallization of sea-salt:—the quantity contained in the ley is about one-eighth. The salt thus obtained is again dissolved and recrystallized: but it is still combined with some Chloride of Magnesium; and, therefore, it is deliquescent. To remedy this objection, Sulphate of Magnesia is prepared, in Italy and some other parts, from Magnesian Schistus, which contains Magnesia and a sulphuret of iron and of copper. By roasting this mineral, the sulphurets are decomposed and the iron and copper oxidized, whilst the sulphuric acid, formed by the oxygen evolved during the decomposition of water, with which the roasted mineral is moistened, combining with the sulphur, unites with the Magnesia as well as with the oxides of iron and copper, and forms

Sulphate of Magnesia, sulphate of iron, and sulphate of copper. The addition of lime decomposes the metallic sulphates, and forms an insoluble sulphate of lime, at the same time that it renders the metals insoluble by reducing them to the state of oxides; and thus it enables the Sulphate of Magnesia to be readily separated by lixiviation and crystallization. In this country it is prepared by calcining *Dolomite* Magnesian-limestone, which consists of Carbonate of lime and of Magnesia. After the calcinations, it is treated with hydrochloric acid, in a quantity sufficient only to take up the lime; and, lastly, sulphuric acid is added, and the Sulphate of Magnesia crystallized. In this process, calcining the magnesian limestone expels the carbonic acid, and leaves Magnesia and lime; hydrochloric acid, diluted with ten or twelve times its weight of water, is then added in quantity sufficient only to take up the lime; the Chloride of Calcium thus formed is held in solution, whilst the Magnesia, being insoluble, precipitates; the two products are now easily separated by decantation, and the Sulphate of Magnesia is formed by the addition of the sulphuric acid to the Magnesia. This process was invented by Dr. Henry; and the salt so prepared, containing no chloride of Magnesium, is not deliquescent. When slowly crystallized, it forms either irregular, six-sided, or quadrangular rhombic prisms, surmounted by six-sided or quadrangular pyramids, or by reversed dihedral summits: but the crystals vary according to circumstances; and, as the usual form of the crystals is acicular, it is preferable to crystallize the salt in this form, which is effected by evaporating the solution to a pellicle. Whatever may be the modification of form of the crystals, they are slightly efflorescent. The taste of Sulphate of Magnesia is extremely bitter; but it nevertheless agrees better with the stomach, in its most irritable state, than any other salt. It dissolves in its own weight of water at 60°, and in three-fourths of its weight at 212°. In solution, the salt increases the bulk of the fluid $\frac{4}{10}$ths of its volume: thus a solution of ℥i of Sulphate of Magnesia in f℥i of water will measure f℥xi and $\frac{1}{4}$. When heated, it undergoes the watery fusion, and loses its water of crystallization; but it is decomposed only in a white heat. Its constituents are sulphuric acid 32·52, + magnesia 16·26, + water 51·22, = 100; or 1 eq. sulphuric acid = 40·1, + 1 magnesia = 20·7; 7 water (9 × 7) = 63, equiv. 123·7.

Sulphate of Magnesia, notwithstanding its cheapness, is said to be occasionally adulterated with sulphate of soda: but I have never met with it. To determine the quantity of pure Sulphate of Magnesia which any specimen of the salt contains, Mr. Phillips recommends the following process. Dissolve 100 grains of the salt in distilled water, and add to it an equal weight of carbonate of soda in solution; boil the mixture, and wash and

dry the precipitate: the result should be thirty-four grains; and any deficiency is caused by an admixture of sulphate of soda. Sulphate of Magnesia is decomposed by sesquicarbonate of ammonia, by carbonate of potassa, lime-water, salts of baryta, salts of oxide of lead, and chloride of calcium.

As a Purgative, Sulphate of Magnesia is a very valuable article of the Materia Medica. It purges without causing griping; but it often proves flatulent; and therefore requires to be conjoined with some aromatic tincture, or bitter infusion, such as those of cascarilla or calumba, or quassia. An elegant form of prescribing Epsom salts is in the infusion of confection of roses, acidulated with diluted sulphuric acid; in which form it allays the vomiting that often occurs in fevers, when other means fail. It operates chiefly on the duodenum; and when exhibited in a full dose, from ʒiv to ʒvi, in a *small* quantity of water, and a large quantity of tepid water drank half an hour afterwards, it operates briskly: but it generally requires some adjunct to ensure a decided evacuation of the intestines.

As I have already stated, Sulphate of Magnesia forms the active ingredient in many mineral waters. At *Aix*, in Savoy, it is conjoined with sulphates of soda and of lime, and a large proportion of carbonate of lime and carbonate of Magnesia; in the *Barege* waters, with carbonate and sulphate of lime; in the *Kilburn*, *Moffat*, and several other waters, with sulphate of soda and sulphate of lime. Sulphate of soda, however, is a more common ingredient in mineral waters than Sulphate of Magnesia. Mineral waters of this description are, therefore, merely combinations of various purgative salts, in conjunction with some gases and other substances, with which they cannot be united in an artificial state. Much of the beneficial effects of *purgative mineral waters* arises evidently from the continuance of their use for a longer time than patients are generally willing to take artificial purgatives; from their daily employment being accompanied with exercise in the open air; from the great degree of dilution in which the salts are administered; and, not least, the freedom from business, care, and anxiety, which those who visit mineral springs generally enjoy. It has been the fashion of late years to order mineral waters, in private practice, to patients residing in large towns, especially in the metropolis; but, the fact of situation and circumstances seem to have been forgotten; and also that the dilution, which is so useful at the springs, tends only to oppress the stomach and weaken the digestive organs in town, where the exercise, after the dose is taken, cannot be easily resorted to, and the habits of life are altogether different from those at watering places. Dilution aids greatly the purgative properties of the Sulphate of Magnesia in every situation: but it is preferable to drink the water or bland fluid, in a tepid state, half an hour after swallowing the dose of the

salt dissolved in a small portion of water, than to combine the two together. The purgative, in this case, is left to stimulate the excretory ducts of the liver and the pancreas, and to cause a copious discharge of the important secretion of these glands into the duodenum, where the fluid taken dilutes them, and aids in carrying them forward into the other intestines. It is by the augmented discharge from the biliary duct, and the duct of the pancreas that the principal benefit which accrues from the administration of this purgative is derived. If the surface be freely exposed to cold air, the salt does not operate as a purgative, but as a diuretic; and, in some instances, it seems to pass off by the surface. Under every form, whether prepared by the hand of Nature or that of Art, Sulphate of Magnesia is a very valuable purgative. The dose is ʒiv to ℥iss.

Compound Saline Powder, *Pulvis Salinus compositus*, E. is a mixture of pure Chloride of Sodium and Sulphate of Magnesia, of each ℥iv and Sulphate of Potassa ℥iii, dried separately with a gentle heat, and then triturated together. This is a useful combination of saline purgatives. The dose is ʒii to ʒiii.

2. Sulphate of Soda. *Sodæ Sulphas*. L. E. D.—Sulphate of Soda is contained in many mineral waters. For medicinal use, it is generally prepared on a large scale, and at so low a price that the process of the Pharmacopœias is seldom employed. In the officinal process, the excess of sulphuric acid in the residue of the distillation of hydrochloric acid from sea-salt, is ordered to be saturated with carbonate of Soda, and crystallized; the salt thus formed, however, is not worth the price of the Soda employed. The Edinburgh College neutralizes it with white marble. When well prepared and carefully crystallized, it forms in six-sided oblique rhombic prisms, terminated by dihedral summits; these are usually channelled, and always exceedingly irregular. It effloresces in the air; and, when exposed to heat, undergoes the watery fusion, losing the whole of the water of crystallization: and the salt becomes opaque and white. The taste of Sulphate of Soda is saline, bitter, and nauseous, but cooling. It dissolves in an equal weight of water at 77°, and in one-third part at 91·5°; but it is a singular fact, that beyond this temperature it is less soluble: boiling water takes up only an equal weight of the salt. It is insoluble in alcohol, which throws it down in its watery solution. According to the analysis of Berzelius, the crystallized salt consists of—sulphuric acid 24·76, + soda 19·24, + water 56, = 109 parts; or of 1 eq. acid = 40·1, + 1 soda = 31·3, + 10 eq. water (9×10) = 90, making the equiv. = 161·3. If a saturated solution at 91·5° be evaporated at a higher temperature, opaque, anhydrous crystals of the salt, the primary form of which is a rhombic octohedron, are deposited.

This salt is contained in many mineral waters; it is also

found in the ashes of many vegetables; and effloresced on brick walls whitewashed with certain compounds, as on those in the lowest part of London University College. From a similar cause, it is found both crystallized and effloresced in some caves near the village of Muhligen, in the Canton of Argovie in Switzerland. The artificial salt was first prepared by Glauber, a German chemist, who named it *sal mirabile;* but it has been always more generally termed Glauber salts. Before the introduction of Epsom salts, the Sulphate of Soda was the most common purgative: it is now less generally employed. It is, nevertheless, a very certain purgative, and its nauseous taste may be covered either by the addition of a little citric or tartaric acid. The chlorides of calcium and of magnesia, and the salts of oxide of lead and of baryta, decompose this salt; and are, therefore, incompatible with it in prescriptions. In the usual crystallized state, the dose is from ʒiv to ℥ii in any bland fluid.

3. Phosphate of Soda. *Sodæ Phosphas.* L. E. D.—Phosphate of Soda is found in some mineral springs, and is a constituent of human urine. According to the Edinburgh and Dublin Pharmacopœias, it is prepared from the superphosphate of lime, obtained from calcined bones acted upon by sulphuric acid, carbonate of Soda being afterwards added. A double exchange takes place, the sulphuric acid unites with a portion of the lime, forming an insoluble sulphate and a soluble superphosphate, whilst the soda of the carbonate attaching itself to the excess of phosphoric acid, forms a soluble phosphate; which, after filtration, to separate the phosphate of lime, slowly crystallizes. It generally contains some traces of sulphuric acid, if it be not repeatedly dissolved in distilled water and recrystallized.

Phosphate of Soda crystallizes in oblique, rhombic prisms, large, regular, and transparent, which effloresce when exposed to the air, and fall into an opaque, white powder. The taste of the salt is cooling, somewhat like that of common salt; a little more urinous, but not unpleasant; it dissolves in four parts of water at 60°, and in two parts at 212°. When heated, it undergoes the watery fusion; and, in a red heat, melts into a white enamel. Chloride of magnesium and chloride of calcium, salts of baryta, acetate of lead, and nitrate of silver, decompose it: all of these substances are therefore incompatible with it in prescriptions.

Phosphate of soda is often adulterated with sulphate of soda when it is in an efflorescent state. This may be discovered by dissolving 100 grains of the suspected salt in water, and adding to the solution acetate of baryta, as long as any precipitate falls. The deposite is then to be well washed and treated with nitric acid, which dissolves the whole of the precipitate, if the phosphate be pure, but leaves an insoluble sulphate if it be adulte-

rated with sulphate of soda. The weight of the Sulphate of Baryta indicates the extent of the adulteration.

According to the analysis of Berzelius, it consists of—phosphoric acid 20·33, + soda 17·67, + water 62·00, = 100; according to Mitcherlich, its constituents are—1 eq. phosphoric acid = 71·4, + 2 soda = 62·6, + 15 water (9 × 15) = 135, equiv. = 269·0*. Professor Graham says it contains 24 eq. of water.

Before this salt was artificially formed, it had been detected in urine and described by Hellot in 1737. Haught afterwards described it under the name of *sal mirabile perlatum*: but its real chemical nature was first pointed out by the younger Rouelle in 1776, and his opinions were confirmed by Klaproth, Proust, and Scheele. Dr. Pearson introduced it into use as a purgative. From the similarity of its taste to that of common salt, it is a purgative well calculated for children, as it may be given in broth without being detected. It operates in doses of from ʒvi to ℥ii.

Solution of Phosphate of Soda, *Sodæ Phosphatis Solutio*, E. is merely a solution of gr. clxxv of Phosphate of Soda (free from efflorescence) in f℥viii of distilled water. It should be kept in well-stopped bottles.

4. Tartrate of Soda. *Sodæ Tartras.*—This salt is not ordered in any of the British Pharmacopœias; yet my experience authorizes me to recommend it strongly in dyspeptic habits, when extemporaneously prepared by adding gr. xv of the tartaric acid dissolved in fʒiv of water, to a solution of ʒi of the bicarbonate of soda in f℥ii of water; and taken in the act of effervescence. The carbonic acid which is extricated acts as a gentle stimulus to the nerves of the stomach, whilst the Tartrate formed generally moves the bowels. When it is saturated with the soda, the Tartrate crystallizes in fine needle-form crystals, soluble in their own weight of water. In this state it is a mild purgative, in doses of ʒii; and may be united with any of the aromatic bitters.

5. Potassio Tartrate of Soda. *Sodæ Potassio Tartras.* L. *Potassæ et Sodæ Tartras.* E. D.—*Tartrate of Soda* and of *Potassa*, as it is correctly termed by the Edinburgh and Dublin Colleges, is produced by saturating the excess of acid of the bitartrate of potassa with carbonate of soda, which is decomposed, and its soda combined with the tartaric acid and its carbonic acid dissipated; so that the acid in this case is united with two bases, forming a double salt.

The crystals of this salt are large, beautiful modifications of regular right-rhombic prisms: they are generally produced in halves in the direction of their axis. Their taste is bitter and saline, but not disagreeably so; their solubility is considerable, five parts of water only, at 60°, being required for this purpose.

* Turner's Elements of Chemistry, 4th edit. p. 675.

They slightly effloresce when exposed to the air, but melt in their water of crystallization when they are heated. According to Vauquelin, the anhydrous salt consists of—tartrate of potassa 54, + tartrate of soda 46, in 100 parts; or the constituents may be thus stated—1 eq. tartrate of potassa = 113·63, + 1 of tartrate of soda = 97·78, + 10 water = 90, equiv. 301·41.

This salt was first prepared, and introduced as a purgative by M. Seignette, an apothecary of Rochelle, in 1672: hence the names Salt of Seignette and Rochelle Salt. The discoverer made a large fortune by keeping the preparation a secret; and it was not made public until 1731, when Boulduc and M. Geoffroy discovered its components, and read a paper on the subject to the Academy of Sciences of Paris. It was long a fashionable purgative, and supposed to be fitted for all complaints; hence the name, *Sal Polychrestum*, salt of many virtues. It was thrown out of favour, but was again restored in the form of Seidlitz powders, of which it forms the active basis*. The dose is ℥ss. It may be administered in any vehicle that does not contain acids or acidulous salts. If any of the mineral acids be added in quantities sufficient to acidulate the solution of this salt, the Tartrate of Potassa is converted into the insoluble bitartrate. It is also necessary to avoid combining it with the acetates of lead, nitrate of silver, or the soluble salts of barium, or of baryta and chloride of calcium.

All of these salts of Soda operate moderately upon the whole length of the intestinal canal, stimulating the orifices of the exhalant vessels, and consequently producing serous or thin watery stools: they are therefore well calculated for cases of febrile excitement, and those in which a plethoric condition of the system requires to be reduced. Their influence on the exhalant vessels also promotes absorption; for these two systems sympathize so closely, that the action of the exhalants cannot be augmented without a corresponding increase of that of the absorbents. They are rarely given alone, unless as domestic medicines; but it is of great importance to attend to the incompatibles, and also to the nature of the vehicles in which they are administered, to understand how far they tend to quicken or to retard their action. Thus the addition of sulphate of Soda quickens the operations of infusion of senna; whilst, in weak habits that can scarcely bear the operation of purgatives, its combination with bitters and sulphuric acid sustains the strength, without impairing the purgative power of the salt; and, with the same view, sulphate of iron may be combined with these salts.

* Dr. Paris informs us that the patent Seidlitz powders consist of two drachms of Tartarized Soda and two scruples of Carbonate of Soda in the white paper, and gr. xxxv of Tartaric acid in the blue paper. The union of these form a bitartrate of soda, which, in conjunction with Tartrate of Soda and potassa, operates mildly and effectually on most persons; and is an agreeable medicine.

6. Bisulphate of Potassa, *Potassæ Bisulphas*, D. is formed during the decomposition of nitrate of potassa by sulphuric acid in manufacturing nitric acid; the Bisulphate being the result of the combination of the sulphuric acid with the potassa of the nitrate. It remains in the retort, and requires to be dissolved in water and crystallized. If the solution be not sufficiently evaporated, the acid is separated from the salt, remains in the water, and neutral sulphate of Potassa is formed. If too little sulphuric acid have been used to decompose the nitrate, the salt, instead of being a Bisulphate, is a mixed salt, a sulphate of Potassa and a nitrate of Potassa. The Dublin College orders it to be prepared by the direct combination of its constituents; but this is an unnecessary and expensive process.

Bisulphate of Potassa differs both in its appearance and in its properties from the sulphate. It crystallizes irregularly, sometimes in slender, hexangular prisms, at other times in right rhombic prisms flattened so as to be tabular. Its taste is extremely sour and slightly bitter; it reddens vegetable blues, is soluble in two parts of water at 60°, and less than an equal weight at 212°. If effervesces with alkaline carbonates. When exposed to a red heat, the water of crystallization and the superabundant acid are both driven off. When exposed to a moderate heat, it melts and assumes the appearance of oil, but again becomes white on cooling. Its constituents are sulphuric acid 54·80, potassa 32·87, water 12·33, in 100·00 parts, or 2 eq. sulphuric acid = 80·2, + 1 potassa = 47·15, + 2 water = 18, equiv. 145·15.

In prescribing this salt, it ought not to be united with any of the alkaline carbonates, nor with lime water. The carbonate of Potassa converts it into the neutral sulphate; carbonate of soda and sesquicarbonate of ammonia form new salts with the excess of acid, whilst lime water forms an insoluble salt, and decomposes the bisulphate. It may, however, be combined with sulphates of iron and of zinc, and with most of the vegetable purgatives, particularly with rhubarb, which, although it contain a salt of lime, yet, this being an oxalate, is not affected by the excess of sulphuric acid in the bisulphate. It may also be advantageously prescribed with the sulphate of quina, or Sulphate of morphia, if a purgative be required to be given in conjunction with these salts. In combination with rhubarb, it has been found useful in dyspeptic states of the habit, accompanied, as is usually the case, with torpid bowels. It is also a useful addition to aromatics and bitters. The dose is from gr. x to ʒii, three or four times a day.

7. Sulphate of Potassa. *Potassæ Sulphas*. L. E. D.—When Bisulphate of Potassa is dissolved in a large quantity of boiling water and Carbonate of Potassa added, sufficient to saturate the superabundant acid, the result is a solution of Sul-

phate of Potassa, which, on evaporation, yields the crystallized salt. But this, although the process of the Dublin College, is too expensive in relation to the value of the sulphate; the London College, therefore, orders the excess of sulphuric acid to be expelled by ignition, and the residue dissolved and crystallized. The Edinburgh College orders marble, the carbonate of lime, to saturate the superfluous acid, and the sulphate of lime which is formed to be separated by the filter previous to the crystallization of the Sulphate of Potassa, which is held in solution. Besides these direct processes, it is formed also in several other processes, as, for example, in the preparation of the carbonate of magnesia. In the supernatant fluid, after the precipitation of the magnesia, Sulphate of Potassa is held in solution, and can be obtained by evaporation.

This salt is usually in grouped, transparent crystals, the form of which varies according to the manner in which the crystallization is conducted; but one of the most common forms is a short six-sided prism, terminated with hexædral pyramids, forming a bipyramidal crystal. The primary form of the crystal is a right-rhombic prism. It is inodorous, has a bitter taste, is permanent in the air; and, as it contains no water of crystallization, is a hard salt, and decrepitates when thrown upon burning coals: in a red heat it melts. It dissolves in sixteen times its weight of water at 60°, and in five parts at 212°. It is insoluble in alcohol. Its composition is differently given by different chemists; but it may be thus stated:—sulphuric acid, 45·45, potassa, 54·55, = 100·0, or 1 eq. of sulphuric acid = 40·1, + 1 of potassa = 47·15, making the equiv. = 87·15. ($S.O.^3$ + K. O.)

Sulphate of Potassa, in solution, is decomposed by tartaric acid, which forms crystals of bitartrate of potassa; by chloride of barium, and chloride of calcium; by solutions of acetate and diacetate of lead, bichloride of mercury, and nitrate of silver.

This salt is found in a state of nature in some mineral waters; it is mentioned as a component in the water of Enghein, as analysed by M. Longchamp; but, in the analysis of the same water by M. Fremy and the junior M. Henry, no mention is made of the Sulphate of Potassa. It is found in the roots of Polygala *Senega*, Winter's bark, Opium, Myrrh, the bulbs of Garlic, and some other plants, and is also contained in urine and some other animal juices*. It is a useful purgative; but, from its little solubility, it is seldom given alone, and scarcely ever in solution. It is supposed to extend its action beyond the bowels, and therefore is generally preferred as a purgative in cases of

* It was known at a very early period under a great variety of names; as, for instance, *Specificum purgans, nitrum fixum, arcanum duplicatum, panacea holsatica, sal polychrest, &c.*: the present name, Sulphate of Potassa, was imposed by the French in 1787.

visceral obstructions; but I am inclined to believe that any effect of this nature is confined to the liver and the pancreas, and that it acts upon them by stimulating the orifices of their excretory ducts, in its passage through the duodenum. The dose for an adult is from a drachm to three drachms. It is generally given in combination with jalap, rhubarb, aloes, or some resinous cathartic. In combination with aloes, as it acts on the duodenum, and the bitter of the aloes supplies the deficiency of bile, it is useful in jaundice, dyspeptic affections, and habitual costiveness in persons of sedentary habits*.

8. BITARTRATE OF POTASSA. *Potassæ Bitartras.* L. E. D. —In wine casks, during the slow fermentation which goes on in wine, a thick crust is deposited on the sides of the casks, tinged of a brown or reddish colour, according to the nature of the wine. This is familiarly termed *argol*, or *crude tartar*. It contains, besides the colouring matter of the wine, some extractive and tartrate of lime, and a large proportion of Bitartrate of Potassa. This bitartrate is also contained in the pulp of some fruits. The usual process for purifying this impure salt is operose†; but it may be equally well effected by simply boiling it with recent powdered charcoal, according to the directions of Schaub.

The crystals of this purified salt are small, irregular, right rhombic prisms, with one of the sides striated. They have an acid taste, a nauseous arriere-gout, feel gritty between the teeth, and are easily pulverized. The specific gravity is 1·953. They require sixty times their weight of water at 60°, and forty times their weight at 212°, for their solution. The salt is not altered by exposure to the air; but its solution, when long kept, is decomposed, a mucous matter is deposited, and carbonate of potassa, coloured with a little oil, remains in solution. This is owing to the decomposition of the acid and of the water, the oxygen of which, uniting with the carbon of the acid, goes to form the carbonic acid that combines with the potassa, whilst the abstraction of part of the carbon, and the addition of hydrogen to the original quantity, form the mucus.

The Bitartrate of Potassa of commerce is seldom pure, containing always more or less tartrate of lime. The constituents of the pure salt, according to Berzelius, are—tartaric acid 70·45, potassa 24·80, water 4·75, = 100·00, or 2 eq. of tartaric acid = 132·96, 1 potassa = 47·15, + 1 water = 9, equiv. 189·11.

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* The Duke of Holstein, as we are informed in Shaw's Life of Boyle, some time before 1663, purchased the secret of preparing this salt for 500 dollars, as a remedy in fever, stone, and scurvy. The term *Sal Polychrest*, which was applied to it, as well as to the Tartrate of Potassa and Soda, demonstrates the estimation in which these salts were held by the elder physicians. It is a good mechanical agent in assisting the pulverization of opium and some of the tough gum-resins, which are apt to become soft under the action of the pestle.

† London Dispensatory, art. Potassæ Bitartras.

From the manner in which this salt crystallizes when prepared in the large way, it has acquired the name of Crystals of Tartar*. It is a cooling purgative, operating on the whole length of the intestinal canal, stimulating the exhalants, producing watery stools, causing flatulence, and often griping. Owing to its property of evacuating watery stools, it is a useful purgative in ascites, and other dropsical accumulations. Its continued use is productive of emaciation: consequently, it is employed in cases of plethora and obesity. As it is little soluble, it is generally given in the form of electuary, combined with jalap, or sulphur, or the electuary of senna. The addition of one-fifth of borax, or one-ninth of boracic acid, to the Bitartrate of Potassa increases greatly its solubility. It is incompatible with the chlorides of barium and calcium, and the salts of oxide of lead. The dose is from gr. xv to ℥iii twice or three times in the day.

9. Tartrate of Potassa. *Potassæ Tartras.* L. E. D.—By adding as much of the carbonate of Potassa to the solution of the Bitartrate of Potassa as will saturate the excess of Tartaric Acid, this neutral Tartrate is formed. It has a bitter, nauseous taste. Its specific gravity is 1·5567. It is generally in the form of powder; but it should always be crystallized; the form of its crystal is an irregular rhombic prism, or six-sided prism, with converging dihedral summits. It is soluble in its own weight of water, at 50° Faht. and still more soluble in hot water; whence its name *soluble Tartar.* But, in its usual granular form, it requires four times its weight of water for its solution; it also attracts water from the air. Like the Bitartrate, it is decomposed when kept in solution. When imperfectly prepared, it may contain Bitartrate of Potassa, which is easily detected by litmus; or carbonate of Potassa, which is made evident by turmeric paper. If any sulphate be combined with it, the chloride of barium will throw down a precipitate insoluble in nitric acid; whilst chlorides are detected by nitrate of silver throwing down a precipitate insoluble in nitric acid. Such adulterations, however, rarely occur. It contains exactly half the proportion of acid which the Bitartrate contains. According to the analysis of Berzelius, it consists of—tartaric acid 58·69, + potassa 41·31, = 100·00, or 1 eq. of tartaric acid = 66·48, + 1 potassa, = 47·15, 2 of water = 18, making the equivalent 131·63.

Tartrate of Potassa is decomposed by all the acids and acidulous fruits, which throw down insoluble crystals of the bitartrate. It is also decomposed by lime-water, chloride of calcium,

* Paracelsus, the Prince of Empirics, says Van Helmont, in his Historia Vini Tartratis, asserted that the name *Tartar* is derived from its producing the oil, water, tincture, and salt, which burn the patient as hell does; he also affirmed that it is the principle of every disease and of every remedy.

and of magnesium, nitrate of silver, and the acetate and diacetate of lead and barium; all of which form with it tartrates of the metallic oxides, and are consequently incompatible with it in prescriptions.

This salt is a mild, efficient purgative, operating without griping: it has also the power of rendering other purgatives—as, for example, senna and scammony—less griping. Its influence is exerted on the whole of the intestinal canal; and it operates very quickly. It is one of the most common purgatives given to carry off full doses of calomel through the bowels. From three to six grains of calomel are given at bed-time; the next morning, a draught containing from ʒi to ʒii of Tartrate of Potassa in f℥iss of infusion of senna, and fʒi of some warm tincture, is administered. This operates rapidly, and sweeps away the bile which the calomel has brought down from the gall ducts. The usual dose of the Tartrate is from ʒi to ʒiv, mixed with infusion of senna, or infusion of rhubarb.

10. ACETATE OF POTASSA. *Potassæ Acetas.* L. E. D.—Each of the British Colleges has its peculiar formula for this salt.

The *London* orders lb. i of Carbonate of Potassa to be added to f℥xxvi of Acetic Acid, diluted with f℥xii of distilled water; and then to evaporate the solution in a sand bath, applying the heat continuously until the salt be dried.

The Edinburgh College dissolves ℥vii or a sufficiency of dried Carbonate of Potassa in Oiss of Pyroligneous acid, till saturation is accomplished. The solution is then to be evaporated until it form a concrete mass when cold; which must be broken up when cool, and immediately put into well-stopped bottles.

The *Dublin* College orders any quantity of Carbonate of Potassa, from Tartar, to be added to five times its weight of distilled vinegar moderately heated; and more of the vinegar to be added as the solution evaporates, till effervescence ceases. It is then to be evaporated to dryness, the salt liquified by raising the heat, and again dissolved in water. The filtered solution is lastly to be evaporated till it becomes, on cooling, a white crystalline mass; which is to be put immediately into well-closed vessels.

Potassa has a powerful affinity for acetic acid; therefore, when carbonate of potassa is added to acetic acid, the carbonic acid is driven off in the state of gas, and the solution being evaporated until a pellicle is formed, the Acetate of Potassa is procured. By the employment of acetic acid, or pyroligneous acid, instead of distilled vinegar, which was formerly used, the salt is now obtained of a pure white colour. In the large way, Acetate of Potassa is formed with the unpurified pyroligneous acid; it is, therefore, requisite to blanch the foliaceous crystals by melting them in a gentle heat; adding animal charcoal; pouring over

the cooled mass distilled water; adding some purified acetic acid; and again evaporating the fluid to obtain the foliaceous crystals.

Acetate of Potassa, when properly prepared, is in masses, having a foliated satiny texture, white or colourless; with a slight, peculiar, faint odour, and a warm, saline, acrid taste. It is extremely deliquescent in the atmosphere, and, consequently, very soluble in water. It is also soluble in four parts of rectified spirit. It is decomposed by the strong mineral acids, which expel the acetic acid; the sulphates also decompose it. When the acetic acid which is employed in its formation contains lead or copper, it gives precipitates with sulphuretted hydrogen, ferrocyanate of potassa, and tincture of galls; but none of these are found in pure acetate of potassa made from pyroligneous or acetic acid. When exposed to a strong heat, Acetate of Potassa is decomposed; the hydrogen of the acid is expelled, and the carbon and oxygen uniting to form carbonic acid, this combines with the potassa and forms the carbonate. This acetate, in its anhydrous state, consists of—51 of acetic acid, + 49 potassa, = 100 parts; or 1 eq. acetic acid = 51·48, + 1 potassa = 47·15, making the equivalent 98·63.

In small doses, this salt operates as a diuretic; in larger doses, that is, from ʒii to ʒiv, as a purgative. In administering it for purgative purposes, the surface of the body should be kept warm. It is, however, an indifferent purgative. It is incompatible in prescriptions with sulphate of soda and sulphate of magnesia, bichloride of mercury, and nitrate of silver, besides the other substances already stated.

The purgative salts of potassa, like those of soda, operate by producing large serous evacuations; and, therefore, they form powerful agents in the antiphlogistic or depleting plan of treatment, as it is termed. In cases which require the habit to be brought down rapidly, the tartrates are preferable to the sulphates or to the acetates; but, regarding the salts of potassa as general purgative agents, in the cases for which purgative salts are peculiarly indicated, I have no hesitation in adjudging the superiority to those of soda.

d. DRASTIC CATHARTICS.

Drastic Cathartics are medicines which operate by powerfully stimulating the intestinal canal, affecting equally the nerves of sensation and those of motion. They consist chiefly of organic products, containing some very active principle, generally involved in substances that, from their inertness, seem intended rather to obtund its energy than to aid its cathartic properties. Their operation is usually attended with griping; and, in many instances, the effects are so violent, that, unless their operation be closely watched, much mischief may result from their em-

ployment. They exert a very powerful influence on the intestinal exhalants and the absorbents; and thus merit the term *Hydragogues* more than any other set of cathartics: indeed, when the powers of the system are capable of bearing up against the debility which they produce, there is no set of remedies so much to be relied upon in the treatment of dropsical affections, unconnected with organic disease.

ORGANIC PRODUCTS OPERATING AS DRASTIC CATHARTICS.

a. COLOCYNTH. *Pulpa Colocynthidis.* L. E. D.—Colocynth is brought to this country from the Levant. It is the fruit of the Cucumis *Colocynthis*, an annual plant which grows in great abundance in Turkey, Syria, the Greek Archipelago, Cape of Good Hope, Coast of Barbary, Japan, Coromandel, and Nubia; and is cultivated in Europe, although it never attains to perfection there. The Colocynth, or Bitter Cucumber, as it is termed, belongs to the natural order Cucurbitaceæ*. The fruit of this plant is a globular pepo, about the size of a small orange, smooth on the outside, 3-locular, each cell containing many ovate, compressed, whitish, sometimes brownish seeds, enclosed in a white, spongy, membranous substance. It is seldom imported into this country with the outer coat on, but it is brought in the peeled state, having been dried in a stove, which converts the pulp into a white, easily torn, papery-looking matter. In this state, it is commonly called the *Coloquintida Apple*. It is brought from the Levant.

The dried Colocynth is inodorous; the white spongy part is intensely bitter and nauseous. It is usually in the proportion of 28 to 72 of the seeds†. When the watery extract of this spongy body is macerated in alcohol, it yields its bitterness and communicates a yellow colour to the spirit: and, when this is evaporated, it leaves a resinous substance, which Vauquelin, who first obtained it, regards as the active principle of the drug, and named it *Colocynthin*‡. It differs from resin in being partially soluble in water, so that the alcoholic tincture is not decomposed when poured into water. It resembles the bitter principle obtained from other plants; but differs from it in some respects. It is not affected by the reagents which usually affect vegetable bodies, except the Tincture of Galls, which precipitates it: the protosulphate of iron and the sulphate of copper coagulate the aqueous infusion, as do also the acetate and diacetate of lead; but nitrate of silver produces no effect upon it. The spongy residuary mass of pulp swells and becomes diaphanous, resem-

* Woodville's Med. Bot. 3rd edition, p. 189, pl. 71. London Dispensatory, art. Cucumis. Richard, Hist. Nat. Med. t. ii, p. 644. Nees v. Essen. 268. Lindley, 84.

† The seeds are bland, and are used as food in Northern Africa.—Captain Lyon's Travels.

‡ Journ. de Pharm. tome x, p. 416.

bling the appearance, in some degree, of tragacanth, when soaked in water:—but it is not soluble in either water or alcohol: I am inclined to consider it a modification of Cerasin. Ether, when digested on the pulp, takes up both resin and the bitter extractive: when evaporated on water, it leaves a pellicle of the former, white and opaque, whilst it communicates an intense bitterness to the fluid. According to Braconnot, the constituents of the watery extract are—41·4 of Colocynthin, 4·3 Resin, 18·6 vegetable jelly, 21·4 azotized matter, 5·7 Acetate of Potassa, and 7·1 deliquescent salt of Potassa, not soluble in alcohol, =100·0*; but the results obtained from the chemical examinations of Colocynth hitherto made, are by no means satisfactory, and cannot be regarded as elucidating the nature of its purgative principle.

Colocynth was well known to the ancients as a Drastic Cathartic, which required to be cautiously administered: they employed it chiefly in dropsical and lethargic affections. The watery decoction or infusion is much less violent in its effects than the alcoholic. On account of its extreme bitterness, however, it is usually given in the form of extract, made into pills. Its drastic qualities are much mitigated by combining it with camphor and hyoscyamus. From the experiments of Orfila, Colocynth appears to exert its influence chiefly on the rectum, which, in dogs killed by taking it, was always found inflamed; and this occurred whether the Colocynth was applied to a wound on the thigh, or was taken into the stomach. When swallowed, even in moderate doses, it gripes violently whilst it purges; in large doses it occasions bloody stools and inflammation of the colon. Several instances of fatal effects from its use are recorded by Continental practitioners; and Dr. Christison quotes a case from the Courier newspaper, in 1823, of an inquest held on the body of a woman who died in twenty-four hours, with incessant vomiting and purging, in consequence of having swallowed, by mistake, a tea-spoonful and a half of powdered Colocynth†. Dr. Fordyce mentions the case of a woman who was subject to colics for thirty years, in consequence of only once taking an infusion of the pulp of Colocynth prepared with beer. Notwithstanding its violence, it is a Cathartic in daily use. When given in substance, the dose is from five to ten grains; but it is necessary to obtund its operation by triturating it with gum, or some other farinaceous matter. The difficulty of reducing it to powder is a sufficient reason for seldom giving it in substance. The aqueous decoction is milder in its effects than either the powder or the extract, and has been occasionally given in worm cases.

EXTRACT OF COLOCYNTH, *Extractum Colocynthidis*, L. E. D. is made by boiling lb. i of Colocynth cut into pieces in *Cong.* ii (i Cong. D.)

* Journ. de Phys. lxxxiv, 337.

† Treatise on Poisons.

of distilled water, over a slow fire, for six hours, keeping up the quantity of water by frequent additions: then straining the liquor while it is hot; and, lastly, evaporating to a proper consistence. One hundred pounds of pulp produce sixty-five pounds of extract. The dose is gr. x to ʒss.

COMPOUND EXTRACT OF COLOCYNTH. *Extractum Colocynthidis compositum.* L. D.—Macerate ℥vi of sliced Colocynth in *Cong.* i of proof spirit for four days, with a gentle heat; strain the liquor, and add ℥xii of purified Extract of Aloës (Hepatic Aloës, D.) in powder; ℥iv of Scammony in powder; and ℥iii of Soap: evaporate to a proper consistence, and towards the close add ℥i of powdered Cardamoms. This valuable compound is sometimes adulterated with chalk and starch; the former is readily detected by dropping a small ball of it into water and adding hydrochloric acid: the latter, by boiling, acidulating slightly the decoction; and, when cold, testing it with Iodine*. Various other adulterations also take place. Dose, gr. v to ʒss: it is often prescribed in conjunction with Extract of Hyoscyamus.

COLOCYNTH PILLS. *Pilulæ Colocynthidis.* E. D.—Take of Soccotrine or Indian Aloës (Hepatic Aloës, D.) and Scammony, of each *eight parts* (ʒi, D.); Colocynth, *four parts* (ʒss, D.); Sulphate of Potassa and Oil of Cloves, of each *one part* (ʒi, D.); Rectified Spirit, a sufficiency (Castile Soap, ʒii; Molasses, a sufficiency, D.). Powder the Aloës, Colocynth, and Sulphate of Potassa together, and having added the Volatile Oil, and Spirit or Treacle, beat to a proper consistence. Dose, gr. v to gr. xv.

PILLS OF COLOCYNTH AND HENBANE, *Pilulæ Colocynthidis et Hyoscyami*, E. are prepared with *two parts* of Colocynth pill mass and one part of Extract of Hyoscyamus, beaten together with a few drops of Rectified Spirit if necessary; and divided into five-grain pills. Dose, gr. v to gr. xv. The Henbane corrects the griping quality of the Gum-resin, without influencing its purgative powers.

CLYSTER OF COLOCYNTH. *Enema Colocynthidis.* L.—Mix and rub together ℈ii of Extract of Colocynth, ℥i of Soft Soap, and Oi of Water. An efficient Enema in obstinate constipation.

b. SCAMMONY. *Scammonium.* L. E. *Convulvulus Scammonia Gummi resina.* D.—Scammony is the product of the Convolvulus *Scammonia*†, a beautiful climbing plant, belonging to the natural order Convolvulaceæ. It is a native of Syria, growing in abundance on the mountains between Aleppo and Latachea. The root is perennial, fusiform, and fleshy; the stems are many, slender, and climbing by twining; leaves sagittate, stalked, entire, smooth, truncated, and irregular at the base. The flowers are pale, sulphur yellow, on solitary three-flowered peduncles.

Scammony is the concreted juice of the root of this Convolvulus. In the month of June, the roots which have attained to the diameter of three or four inches are cut across in a sloping

* Pereira's Elements, second edition, page 1498.

† Woodville's Med. Bot. 3d edit p. 213, pl. 86. London Dispensatory, art. Convolvulus. Richard, Hist. Nat. Med. t. ii, p. 122. Hayne, xii, 35. Lindley, 398.

direction, the earth having been first cleared away from them. The slicing is made about two inches below the place where the stalks spring; and a shell being placed at the lowest part of the cut surface, the milky juice which issues is collected in it. Each root yields a few drachms only; the different collections from a vast number of roots are put indiscriminately together, so that every kind of Scammony is sometimes found in the same package.

Aleppo Scammony is now never brought to England. Three kinds are found in the market: *Virgin Scammony, seconds,* and *thirds.*

1. *Virgin Scammony* is in irregular masses, compact, friable, and breaking with a regular, smooth, faintly shining fracture. Hydrochloric acid should cause no effervescence on the surface; and the decoction of its powder when cooled should not be tinged blue by iodine. Its odour is peculiar, not unlike that of old ewe-milk cheese; and the stronger this odour is, the better is the Scammony: its taste is bitterish and slightly acrid. The colour is a dark-grey, and, if good, it lathers or turns to a dirty white when it is rubbed with a moist finger.

Thin splinters, examined by transmitted light, are semi-diaphanous and of a greyish-brown hue.

2. *Second Scammony* is heavier than the former variety, its fracture is duller, and its colour greyish: but the best specimens of it closely resemble Virgin Scammony in other respects. It is sometimes adulterated with chalk; occasionally with flour as well as chalk.

3. The *third* quality of Scammony is in flat, heavy, hard cakes, about an inch thick: its fracture is resinous and shining; its colour greyish, approaching to black. This kind contains from 13·07 to 37·54 parts of chalk*.

When good Scammony is triturated with water, it forms a milky or emulsive solution, which lets fall, on standing, a portion of insoluble resin. From the best specimens I could procure, I have never procured more than 80 per cent. of resin, and from 8·5 to 10 of gum. I agree with Dr. Christison†, in regarding the starch as an accidental ingredient. The pure resin, when separated, is inodorous and insipid. The aqueous solution of Scammony is altered by some of the solutions of the metallic salts, especially diacetate of lead: when liquor potassæ is dropped into it, a yellow precipitate is formed, which is quickly dissolved on the addition of an acid: it is probably a compound of extractive and potassa, which is insoluble in water. The gum remains in solution with the alkali; and if the solution be strong, it is precipitated by alcohol. Alcohol takes up six-tenths of the Scammony; this is nearly pure resin, and may be

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* Pereira's Elements, p. 1266.
† Dispensatory, p. 832.

precipitated from the alcoholic solution by means of water. According to the analysis of Vogel and Bouillon La Grange*, Scammony is composed of—

	Aleppo.	Smyrna.
Resin	60	29
Gum	03	8
Extractive . . .	02	5
Waste	35	50
	100	100

But, according to Marquart, the following are the constituents of what he terms Aleppo Scammony, in irregular masses, of sp. gr. 1·239:—785 of *Resin*, 1·5 *wax*, 3·5 *extractive*, 20·0 *extractive with salts*, 2·0 *gum with salts*, 1·5 *starch*, 1·25 *starchy envelopes*, *bassorin* and *gluten*, 3·5 *lignin*, 2.75 *earthy salts*, and 3·5 *sand*, = 100.00. The resin is the active principle.

It is said that the root of the plant, after it has been drained of the milky juice, is still Cathartic; which, however, probably arises from some of the juice being left concreted in the vessels of the root. The adulterations of Scammony, in reference to the English market, consist of chalk and starch, which diminish the resin in the ratio of the chalk and starch employed. Dr. Christison, who has investigated this matter, says that, in some specimens containing both chalk and starch, the resin amounted only to 42 per cent., little more than half the due proportion†.

Scammony is a powerful Drastic Cathartic, very apt to gripe when given alone. Its activity resides in the resin, which is too drastic when separated from the gum and extractive. The ancients employed Scammony as an external application to tumours, itch, scurf, and fixed pains; which is rather surprising, as it purges almost as freely when rubbed upon the skin as when taken into the stomach. Its acrimony, also, as a purgative, was so constantly kept in view by the ancients, that they invented a variety of methods for correcting it; and they termed the compounds *Diagrydia*. It is usually given in combination with Calomel; and it is one of those substances that sulphate of potassa aids greatly in its action, at the same time modifying its griping quality. It is an excellent occasional Cathartic in leucophlegmatic and hypochondriacal cases; and for removing the scybala that frequently lodge in the colon in maniacal cases. In dropsical diseases, in which there is often torpid bowels, Scammony, in combination with bitartrate of potassa, aids greatly in removing accumulations of serous fluids from internal cavities, when the dropsy is not of an encysted kind. It is also one of the best Cathartics, combined with Calomel and Sulphate of Potassa, in worm cases. Its dose in substance is from gr. v

* Ann. de Chim. lxxii, 69.

† Dispensatory, p. 434.

to gr. xv. When administered, either alone or in combination, it should be conjoined with a drop or two of some volatile oil. The watery infusion is sufficiently active, and does not gripe so violently as the medicine in substance, owing to the precipitation of the resinous part. When given in an overdose, the case must be treated as one of common inflammation of the bowels.

Scammony is administered, in combination, in the form of a compound powder, an extract, mixture, and confection.

COMPOUND POWDER OF SCAMMONY, *Pulvis Scammonii compositus*, L. D. is prepared by pulverizing separately ℥ii each of Scammony and hard extract of Jalap, and ℥ss of Ginger; and mixing them thoroughly together.

EXTRACT OR RESIN OF SCAMMONY. *Extractum sive Resina Scammonii*, E.—Fine powder of Scammony is boiled in successive portions of proof spirit, till the spirit ceases to dissolve any thing: the solution is then to be distilled until the whole of the spirit comes over; after which the residuary watery solution is to be poured off from the resin at the bottom, which is next to be well washed in successive portions of boiling water; and, lastly, dried at 240°.

The Resin of Scammony obtained in this manner is in thin, transparent layers, soluble in alcohol, ether, and the volatile oils. It has a peculiar odour; but when purified by animal charcoal, it is inodorous. Its composition is $C.^{40}\ H.^{33}\ O.^{20}$, a proportion of Oxygen greater than that of any other resin. The dose is gr. vi to gr. xiv.

MIXTURE OF SCAMMONY. *Mistura Scammonii.* E.—Triturate gr. vii of the Resin of Scammony with a little unskimmed milk, gradually adding more, until f℥iii are expended, and an uniform emulsion is obtained.

This mode of forming an emulsion with Resin of Scammony was first suggested by Planche. It forms a useful and efficient purgative draught.

CONFECTION OF SCAMMONY. *Confectio Scammonii*, L. *Electuarium Scammonii*, D.—This is an extemporaneous preparation, and only made into a Confection when required, by combining ℈ii or more of the following powder with Confection of Roses:—Scammony ℥iss, Cloves bruised, Ginger powder, of each ʒvi, Oil of Carraway fʒss—triturate to the state of a fine powder. It is a warm, useful cathartic.

c. CAMBOGE. *Cambogia.* L. D. *Cambogia Siamensis*, E. *Cambogia Zeylanica.* E.—There are various plants, both trees and herbs, which secrete a yellow juice, that thickens in the air, and has something of the appearance of Camboge; but the plant which yields Camboge is not yet certainly known. From the examination of specimens of the tree which yields the Camboge of Ceylon, sent home by Mrs. Walker, Dr. Graham, Professor of Botany at Edinburgh, has ascertained it to belong to a new genus, which he has named Hebradendon, and the species *cambogioides*.

As the Cingalese derive this tree, along with their religion, from Siam, and the Camboge of Ceylon, Dr. Christison* has ascertained, resembles closely in its chemical character that of Siam, there is reason for concluding that the same tree yields the Siamese Camboge†. The name of this drug is derived from Kamboja, a river in Siam, on the banks of which the tree which yields it is said to grow in great abundance. The Ceylon tree belongs to the natural order *Guttiferæ*‡. This tree is of a moderate height, with a tufted head, from the foliage appearing only at the summits of the branches. The leaves are petiolate, ovate, elliptical, opposite, entire, even, rigid, smooth, of a deep green colour, and exuding, when they are bruised or in any manner lacerated, a bright yellow juice, which also exudes in drops that concrete upon the bark. The flowers are unisexual, and produce a round berry, the size of a cherry, with a firm reddish-brown cuticle, and a sweet pulp, enclosing large reniform seeds§. In Siam, the Camboge is procured from the leaves by merely breaking them, and allowing the proper juice to distil into cocoa-nut-shells, in which it is left to harden; and, when sufficiently firm, is formed into rolls and wrapt up in leaves. In Ceylon, it is collected by wounding the tree or cutting a slice from the trunk, whence the juice flows. The juice, after hardening, is transferred into cases and boxes; but none of it is brought to Europe. The Siamese Camboge is imported in three different forms—namely, *Pipe*, *Lump*, and *Coarse* Camboge.—1. *Pipe Camboge* is in hollow cylinders, 1 to 2 inches in diameter, often cohering in pairs, and striated on the surface, which is of a greenish-yellow colour. It is very brittle, breaking with a smooth, glistening, brownish, or deep orange-yellow, conchoidal fracture. Its powder is bright yellow; and the same colour is produced by rubbing it with the finger wetted. It is easily pulverized; melting when heated, and burning in a strong heat with a white flame, leaving a light spongy charcoal, which contains carbonate and phosphate of potassa, chloride of potassium, and carbonate and phosphate of lime. Camboge has no odour, and scarcely any taste; but, after being masticated, it imparts a sensation of acrimony and dryness to the mouth. When triturated with water, it forms a turbid, bright yellow solution, which reddens slightly the tincture of litmus; is rendered transparent by the addition of alcohol: and is not affected by the solutions of any of the metallic salts; but is rendered nearly white when agitated in a bottle of chlorine. Alcohol dissolves *nine* parts in

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* Dispensatory, p. 246.

† Some species of Hypericum, Cheledonium *majus* and C. *minor*, and some exotics, as I have already stated, yield yellow, proper juices; but their juices differ in their chemical properties from Camboge, and are not employed as medicines.

‡ Graham—Comp. to Bot. Mag. ii. 199.

§ Lindley, 113.

ten of Camboge, forming a deep orange-coloured tincture, which, when diluted with water, does not throw down the resin, but produces an uniform milky fluid, and, when evaporated, yields it perfectly free from gum. Ether dissolves it more freely, and, when the etherial tincture is evaporated on water, it leaves a pellicle of very pure, semi-transparent resin.

The best analysis of Camboge is that of Dr. Christison*. The following are the components in two different samples of the best, or Pipe Camboge:—

	First.	Second.
Resin	74·2	71·6
Soluble gum (Arabin)	21·8	24·0
Moisture	4·8	4·8
Lignin	a trace	a trace
	100·8	100·4

2. *Lump Camboge* is in irregular masses, containing often fragments of wood. It is less brittle than Pipe Camboge, contains air cells, and exhibits a splintery, dull fracture: its powder is as bright as that of the pipe kind. According to Dr. Christison, it consists of 64·3 resin; 20·7 arabin; 6·2 fecula; 4·4 lignin; 4·0 moisture, = 100·0. The chief difference between this and the *pipe* is in the fecula and lignin; the former is easily detected by the action of iodine on the cold aqueous decoction of the Camboge.

3. *Coarse Camboge* contains more fecula and lignin. In one specimen, Dr. Christison found 19 per cent. of fecula and 22 of lignin.

The Resin of Camboge is of a deep orange-red colour, is insipid, and possesses an idio-electric property. In the entire state, it is inodorous; but when pulverized, exhales a peculiar odour. When it is acted upon by Liquor Potassæ, a deep red oily solution is formed, which crystallizes when it is evaporated; and, when acids are poured into the solution, yields a coagulum of a beautiful yellow colour. What remains, after the action of alcohol or ether, is nearly altogether soluble in water, and, when evaporated, yields a semi-transparent gummy substance, which Braconnot regarded as Cerasin, but which differs from it in being soluble in water, and is *Arabin.* Lime water, added to the savonule of the resin, deposites a beautiful orange-coloured precipitate: sulphate of iron is precipitated brown, and nitrate of copper green. With alkalies, it yields a deep brown solution, which is precipitated by acids. The resin, when acted upon by nitric acid, is converted into a yellow bitter principle. Johnston supposes this resin to be an acid; he names it Gambogic Acid; and its precipitates with metallic oxides, Gambogi-

* Comp. to the Bot. Mag. ii. p. 235.

ates. He states its composition to be $C.^{40}$ $H.^{22}$ $O.^{8}$; but this opinion requires to be confirmed. These experiments throw no light on its purgative principle.

As a medicine, it is a powerful drastic Cathartic, exciting vomiting when given alone, even in moderate doses, namely, gr. ii to gr. x. It is usually combined with Calomel, Soap, or Rhubarb, for purgative; and with Squills, Bitartrate of Potassa, Sulphate of Potassa, and Nitre, for hydragogue purposes. The alkaline solution, in doses of from thirty to fifty minims in a sufficient quantity of water, given twice or thrice a day, is employed in dropsical affections. It operates both on the bowels and on the kidneys, through the latter of which it passes unaltered, and may be detected in the urine. It was long regarded as a powerful vermifuge in cases of tape-worm; but, since the introduction of oil of turpentine for the expulsion of tænia, the use of Camboge for this purpose has been discontinued. It is more employed as a pigment than as an article of the Materia Medica.

COMPOUND PILLS OF CAMBOGE. *Pilulæ Cambogiæ compositæ.* L. D. *Pilulæ Cambogiæ.* E.—The London and Dublin Colleges order ʒi of Camboge in powder, ʒiss of Aloës, (Hepatic, D.) in powder; ʒss of Ginger, powdered; to be mixed and beaten into a mass with ʒii of Soap (and a little Treacle, D.). The Edinburgh College directs Camboge in powder, East Indian or Barbadoes Aloes, in powder, and Aromatic powder, of each *one part*, to be mixed and beaten into a mass with *two parts* of Castile, and a sufficiency of Syrup, proper for making pills. Dose, gr. x. to gr. xx.

5. BUCKTHORN. *Rhamnus.* L. D. *Rhamni Baccæ.* E.—The Rhamnus *catharticus* is a shrub common in most of the countries of Europe: it belongs to the natural order Rhamnaceæ, of which it forms the type*. The fruit, which is the part used, ripens in September, is a globular, fleshy, black, shiny berry, the size of a large pea, with from two to four fibrous, indihescent seeds: embedded in a green, bitter, nauseous, acrid juice, which, in its recent state, and combined with alumina and lime, forms the pigment called sap-green. This juice is reddened by acids, and again restored by alkalies; so that it is sometimes employed as a reagent to detect the presence of these substances. The aqueous infusion is blackened by the persulphate of iron.

When employed as a Cathartic, the berries operate violently, causing griping, and a sensation of dryness in the throat. It was formerly much used as a hydragogue cathartic; but the violence of the griping which it causes has produced an almost entire ejectment of Buckthorn from the Materia Medica. The interior

* Woodville's Med. Bot. third edit, pl. 210, p. 595. London Dispensatory, art. Rhamnus. Richard, Hist. Nat. Med. t. ii, p. 563. Hayne, v, 43. Lindley, 165.

bark of the young branches is said to purge as violently as the berries. Twenty of the recent berries purge briskly, and the peasantry employ them for this purpose: but the most common form of the medicine is the syrup. Whatever form it may be administered in, it is a medicine of too drastic a nature to be much employed; yet it was the favourite purgative of Sydenham; and it is alleged that much of his success in the early part of his career is attributable to his frequent employment of this Cathartic. It requires free dilution with some bland mucilaginous fluid.

SYRUP OF BUCKTHORN, *Syrupus Rhamni.* L. E. D.—Take of the fresh Juice of Buckthorn Oiv, (Oiss, old wine measure, D.); Ginger sliced, Pimento powdered, each ℥vi (ʒiii, D.), Sugar lb. iv. Set aside the juice for three days to subside, and strain. To Oi of the clear juice add the Ginger and Pimento; then macerate with a gentle heat for four hours, and strain; boil down that which is left to Oiss, mix the liquors; add the sugar and dissolve it. The dose of the syrup is from f℥i to f℥iii. It might be rejected without any disadvantage from the Pharmacopœias.

b. OLEO-RESINS.

The Resin in these compounds is combined with volatile oil; and it is doubtful whether the activity of the substances depends on the resin or the oil. We find both of these components so modified in different plants, as to operate with considerable energy upon the intestinal canal; and perhaps, in every instance, in which a resin can be demonstrated to be the active ingredient in a vegetable purgative, we might be able to detect a volatile, or an acrid fixed oil in combination with it. The only drastic Cathartic containing it is the root of a plant which has been long known in our gardens as one of the earliest harbingers of spring.

HELLEBORE. *Helleborus.* L. E. D.—Black Hellebore, Helleborus *niger*, has long been employed as a substitute for the Helleborus *officinalis*, the plant used by the ancients; nevertheless, the London College has adopted the latter as the plant yielding the Hellebore roots of the shops. The Hellebores belong to the natural order Ranunculaceæ*. The root of the plant is composed of thick, fleshy fibres, of a dark colour. The plant is familiarly called Christmas Rose, owing to its flowering occasionally at Christmas; but more generally it does not flower until the end of January, or even until the commencement of February. It is a native of the hilly parts of Austria, Switzer-

* Woodville's Med. Bot. third edit. p. 463, pl. 169. London Dispensatory, art. Helleborus. Richard, Hist. Nat. Med. t. ii, p. 536. Hayne, i, 7, 8. Lindley, 6.

land, and France, but is much cultivated as a garden flower in this country.

Authors, both ancient and modern, have differed greatly with respect to the actual plant which was employed by the ancients under the name *Helleborus;* and, consequently, it is still doubted whether our Black Hellebore is the real Hellebore of the ancients. Theophrastus and Dioscorides mention both white and black Hellebore, *Elleboros leucos* and *Elleboros melas*. Botanists have agreed that the former is the Veratrum *album* of Linnæus, a plant which I have already described, and which is very different indeed from the modern Hellebores, the family to which our present plant belongs; and there is a dark species of this genus. Tournefort, in a voyage to the Levant and into Greece, and Lamarck, have regarded the Black Hellebore of the ancients to be the Helleborus *orientalis* of Linnæus; and, if the writings of those ancient poets who have described the place of growth of the plant be accredited, these opinions of the French naturalists have some foundation. But although our Black Hellebore is certainly not the celebrated plant of Anticyra, where it does not grow, yet it possesses similar medicinal properties. In the dry state, the root of Black Hellebore is exteriorly of a deep brown, sprinkled with grey; its interior is fleshy, not fibrous; its lateral fibres are fragile. Its infusion, made with water at 60°, has a yellow vinous colour, and is precipitated by tincture of galls; diacetate of lead also throws down a slight precipitate, demonstrating the presence of gum; and sulphate of iron striking a black colour with it, indicates the presence of gallic acid or a gallate, as no tannic acid can be detected by gelatin. Indeed, Feneulle and Capron found a gallate of Potassa in it*.

The taste of the roots of Hellebore is bitter and acrid, leaving an impression of burning upon the tongue. This acrimony is in a certain degree volatile; at least, the acrimony of the plant is impaired by keeping; and when the root is distilled with water, the fluid which comes over is acrid. The virtues of Hellebore, however, seem to depend upon a concrete fixed oil, which is taken up by boiling alcohol: and which may be separated by digesting the root in alcohol, and distilling off the spirit from the tincture: the oil gradually separates and concretes on cooling. When dissolved in weak alcohol, it precipitates the sulphate of iron. M.M. Feneulle and Capron have analysed Black Hellebore, and state its constituents to be—1, a volatile oil; 2, a concrete oil; 3, a resinous matter; 4, wax; 5, a volatile acid; 6, a bitter principle; 7, mucus; 8, allumina; 9, gallate of potassa and of lime; and 10, ammoniacal salt.

Hellebore is a very drastic cathartic. It was one of the chief resources of the ancients: Hippocrates extols its virtues, and

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* Journ. de Pharm. viii, 503.

Galen regards it as the most valuable of all purgatives; but, even at that early period, the violence of Hellebore was so well known as to require the greatest caution in its administration. Perseus attacks the physicians of his time for not knowing the method of moderating the action of Hellebore. The ancients employed their Hellebore in many diseases; but it was chiefly celebrated for its effects in insanity; so much so, that the proverb "send him to Anticyra," the place where the plant was collected, was equivalent to a declaration of his madness*.

The importance of the employment of active purgation in insanity cannot be doubted; and, as the chief object is to dislodge irritating *scybala*, the advantage desired must undoubtedly depend greatly on the activity of the Cathartic. Whether Black Hellebore be the best purgative in such a case, my experience does not enable me to determine; but there can be only one opinion regarding the employment of any purgative capable of effectually clearing out the bowels. So long as the fæces consist of dark, broken-down matters, accompanied with scybala, the use of active Cathartics is indicated. I may, however, take this opportunity of pointing out the necessity of not carrying the purging too far, and the practical importance of knowing when to desist. If the fæces change in aspect and appearance, become moderately consistent, are more natural in colour, and well tinged with florid bile; if, at the same time, there be a remission of symptoms, and a freedom from pain on compressing the liver, and particularly if there be some reason to suspect the approach of debility; then it is time to discontinue the purging, and support the strength of the constitution by nourishment.

With regard to the ancient use of Hellebore as a hydragogue, there can be no doubt that Black Hellebore, in common with some other drastic Cathartics, produce copious watery evacuations by stool; and hence it is well fitted to carry off dropsical accumulations. The pills of Bacher, that at one time held a high reputation for the cure of dropsy, contain an extract of Black Hellebore. They are now rarely employed; and indeed, except with the view of exciting the uterine organs, Hellebore is scarcely ever prescribed. The dose of the Hellebore root, in substance, is from gr. x to ℈i, or of the decoction f℥i may be given once in four or five hours, which is a safer method of administering it than giving a full dose at once. When it is overdosed, the usual effects are vomiting, delirium, and violent convulsions; and the morbid appearances after death display signs of inflammation in the alimentary canal, particularly in the large intestines, the colon,

Littus ad Euxinum, si quis mihi diceret, ibis,
Et metues, arcu ne feriare Getæ;
I, bibe, dixissem purgantes pectora succos
Quidquid et in tota nascitur Anticyra."—Ovid.

and rectum. A gorged state of the lungs, and a brownish-black or gangrenous appearance of the stomach, have also been observed. I know of no particular antidote for Black Hellebore; and, therefore, when it poisons, the case must be treated as one of simple inflammation of the mucous membrane of the intestines.

TINCTURE OF HELLEBORE, *Tinctura Hellebori*, L. D. is made by macerating ℥v (℥iv, D.) of the root of Black Hellebore, in Oii (f℥xxxii, D.) of proof spirit for fourteen (seven, D.) days, and then filtering. It is employed only as an adjunct to other cathartics. The dose is f℈i to f℈ii.

c. FIXED ACRID OIL.

In the substances arranged under this head, the fixed oil is the mere vehicle of some acrid principle, which is the cathartic agent: but the real nature of this is unknown to us, except as respects its influence on the habit.

1. OIL OF CROTON. *Tiglii Oleum*. L. *Crotonis Oleum*. E. *Crotonis Tiglii Oleum*. D.—The Croton *Tiglium* is a native of Ceylon, the Molucca islands, Cochin China, and the greater part of the East: it furnishes one of the most violent of the Drastic Cathartics. It belongs to the natural order *Euphorbiaceæ**. It is a middle-sized tree, with oval, oblong, or five-nerved leaves, acuminate, thin, membranous, and glandular at the base. The flowers are unisexual, borne on terminal racemes. The fruit, the seeds in which is the part of this tree which yields the oil, like that of the rest of the natural order to which it belongs, is tricoccus, with thin, almost membranous partitions between the cells, each of which contains one seed.

The drastic properties of this plant are found in the roots, the wood, the leaves, and particularly in the seeds. The root is employed in Amboyna and Batavia as a hydragogue Cathartic in dropsy. In the same places, the wood, which is light, spongy, pale, covered with an ash-coloured bark, and has a caustic, pungent taste, and an unpleasant odour, is regarded as a *panacea*†. It is more active in the recent than in the dried state, exciting sweating in small, and purging in large doses. Murray states that the leaves are so acrid that they inflame the lips, mouth, and fauces, and that the heat induced by tasting them extends to the anus. The seeds were employed in medicine, in Europe, at a very early period, under the name of *Molucca grains*, and *Grana Tiglia:* but the imprudent use of them‡, in some cases, caused them to be neglected, until, a few years since, Mr. Conway, a surgeon in the Madras establishment, brought the oil into notice.

* Woodville's Med. Bot third edition, vol. v, p. 71. Richard, Hist. Nat. Med. tome i, p. 584. Nees von Essen. 138. Lindley, 181.

† Rhumphius recommends an infusion of the shavings as an infallible remedy in dropsy.

‡ Geoffrey limits the use of the oil to one drachm!

In India the seeds are still employed; but their acrimony is diminished by roasting, which is done with the view of rendering them more easily pulverized.

The expressed oil of these seeds is of a bright straw or citrine-yellow colour; it has a faint odour, and a hot, extremely acrid taste, which remains long upon the palate and fauces, producing a burning sensation, and a feeling of constriction in these parts. About 50 per cent. is procured by expression.

Dr. Nimmo, of Glasgow, Brandes, and Pelletier and Caventou, have chemically examined both the seeds and the oil. Dr. Nimmo found that the active principle resides in the kernels; for although the husks or shells impart a dark colour to alcohol, yet the tincture is devoid of acrimony. The kernels, which constitute 64 per cent. of the seed, when beaten to a paste, and digested for several days in alcohol, with a moderate heat, and this digestion repeated with fresh alcohol, yielded eleven parts in forty to the spirit, and the residuum was tasteless, although it evidently contained a fixed oil, which greased the paper in which it was dried. Oil of turpentine, purified by agitating with alcohol, in the proportion of eight parts of the oil to one of the strongest alcohol, and decanting off the impurities with the alcohol, was poured upon the residue of the Tiglium seeds, after they had been acted upon by the alcohol; and after digesting for a considerable time, it was found that thirteen of the twenty-nine parts were by these means dissolved: and this being the fixed oil, it appeared that 100 parts of the decorticated seeds contained 27·5 of acrid matter, soluble in alcohol; 32·5 fixed oil, soluble in oil of turpentine; and 40 of farinaceous matter. The expressed oil consists of 45 of this acrid principle, and 55 of fixed oil, in 100 parts. The alcoholic solution reddened tincture of litmus, when dropped into a solution of this colouring matter; it rendered water nebulous when dropped into it; and, when filtered, the clear water which passed the filter was found to be perfectly inert. From these experiments, Dr. Nimmo justly concludes that the acrid principle of these seeds resides in a resinous matter, which is soluble in alcohol, sulphuric ether, and volatile and fixed oils. M. Brandes regards the active principle an acid, which he has named Crotonic acid, and which is contained in the proportion of 17 per cent. of the seeds. It is a fatty acid, so volatile as to vaporize a little above 30°. It combines with alkalies, other metallic oxides, and Ammonia, and forms *Crotonates*: and Brandes asserts that it is combined with *crotonin*, and alkalies, which he discovered in the seeds. The other components of the seeds are a trace of *volatile oil, resin, stearine, and wax, extractive, fecula, gum, albumen*, and *gluten*; besides lignin and water*. When strong alcohol is digested on the oil of Tiglium, and the operation is re-

* Gmelin, Handb. d. Chim. Bot. ii, s. 1320.

peated several times, about a third part of the oil is taken up, and the solution has all the properties of the acrid oil; whilst the undissolved oil which remains is perfectly inert.

The Oil of Tiglium, from its high price, is frequently adulterated with olive or castor oil; to detect this, Dr. Nimmo recommends the following simple process. Put into a phial, the weight of which has been previously ascertained, fifty grains of the oil, add alcohol which has been digested upon olive oil, heat gently, and agitate well; then pour off the solution, and add more oil, acting repeatedly in the same manner. On placing the phial near the fire, to evaporate any remaining alcohol after the alcoholic solution has been decanted off, and weighing the phial with the residue; if we find that it is in the proportion to that which has been abstracted by the alcohol, as fifty-five to forty-five, the oil is genuine; but if the residue be greater, it implies that the oil has been adulterated with olive oil; if smaller, then we may conjecture that it is mixed with castor oil. Dr. Paris has suggested the idea that the alcoholic solution which Dr. Nimmo obtained, contains a principle, sui generis, which he proposes to call Tiglin; but perhaps this proposition is rather premature.

Croton or Tiglium Oil operates exactly in the same manner as other drastic purgatives, except that the quantity requisite is small*; one minim generally purges freely, and four minims have caused violent hypercatharsis: it operates when it is merely applied to the tongue. Notwithstanding its violent action, it seldom excites nausea or vomiting; scarcely ever griping: and this is particularly the case when the alcoholic solution is employed. It may be administered in all cases where a quick and full purging is required: in maniacal cases, and in cases of visceral obstructions, and dropsical accumulations. Dr. Nimmo remarks that he has found this oil, or its alcoholic solution, in combination with opium, extremely beneficial in delirium tremens, a disease which arises generally from intemperance in the use of ardent spirits. In apoplexy I have been enabled to prove the utility of this oil; and have produced free evacuations by merely touching the tongue with the oil, after the faculty of deglutition was altogether suspended; for the same reason, it is extremely useful in maniacal cases, when there is a difficulty of getting the patient to swallow more bulky medicines.

Experience has amply confirmed the value of the Oil of Tiglium as a cathartic; and, with due caution, it is both a safe and not unmanageable medicine. The most common form of giving the oil is that of pill, formed by dropping the oil on crumb of bread; one or two drops proving a sufficient dose. It may be

* Landsberg informs us that m. xxx killed a dog: a seed has proved fatal: and a case is recorded in which inhaling the dust of the seeds proved poisonous.—Pereira's Elements, p. 1113, 2d edit.

given with rhubarb, which readily absorbs it, and can be easily formed into pills. This mode, however, of administering the oil has one disadvantage; namely, it is applied in too concentrated a state to the portion of the stomach on which it rests. I have found that the taste and acrimony of the medicine are well covered by triturating the oil with mucilage and syrup of tolu, and diffusing it through the common almond emulsion. A tincture of the seeds, made by digesting gr. 170 of the decorticated kernels, powdered, in one pound of proof spirit for fourteen days, and then filtering, may be substituted for the oil. The dose of this tincture is from m. 40 to m. 100.

Mr. Morson, of Southampton Row, Russel Square, has manufactured this oil into soap, or, rather, Crotonate of Soda, for internal use, to be given in the form of pills. He asserts that the combination of the oil with the alkali diminishes its acrimony, but does not lessen its cathartic powers. The dose of this soap is from one to three grains: but no form of administering this powerful Cathartic is so good as that of solution in alcohol, as proposed by Dr. Nimmo.

2. Oil of Spurge. *Euphorbiæ lathyris Oleum.*—The species of Euphorbium which yields this oil is a herbaceous plant, a biennial, common to many parts of Europe, belonging to the natural order Euphorbiaceæ*. It is a glaucous plant, rising about 2 to 4 feet in height, with linear-oblong, coriaceous, acute, mucronate, entire, smooth, sessile leaves. Bracts cordate, entire, tapering; the leaves of the involucre lunate; the seeds, which are obovate, truncate at the base, rough and brown, are powerfully excitant, and, when taken into the stomach, operating as a powerful Drastic Cathartic. In France, the fresh fruit is in common use with the peasantry as a purgative; but at the same time it operates also as an emetic, and the vomiting is maintained for several days. If the dried seeds, decorticated, be swallowed, however, their purgative influence only is exerted in a mild manner.

In 1823, M. Barbier suggested the propriety of trying the influence of the expressed oil of these seeds as a purgative. This oil is white, transparent, having scarcely any odour, and a mild taste: like castor oil, it is soluble in alcohol. When kept, it becomes soon rancid and loses its transparency. The oil may be procured by expression; or the active principle may be separated by digestion in alcohol at 30° Beaume, or in ether. Many experiments have been made with it in France, and these have fully demonstrated its purgative properties. From twenty to thirty minims of the expressed oil purge freely, without exciting griping; it does not heat the habit, nor cause thirst, nor affect

* Röper Euphorb. 67. Lindley, 194. It is the Cataputia *minor* of the old Pharmacopœias; and is one of the plants ordered by the capitularies of Charlemagne to be grown in every garden.—Lindley.

the appetite: it operates briskly, without causing that impression on the mucous membrane of the intestinal canal which plays the part of a counter-irritant; it is, therefore, inferior in many respects to oil of Tiglium, and many others of this division of Cathartics. It is, however, well adapted for clearing the alimentary canal in weak and nervous subjects, and in those in whom visceral irritation becomes a strong source of general discomfort, and who cannot sustain the influence of ordinary Drastic Cathartics, whilst at the same time they require an active purgative. The Oil of Spurge may be administered in combination with any of the other purgatives, especially rhubarb, which, from its tonic influence, is well adapted to supply tone to those habits for which it is especially indicated.

3. Tobacco.—An infusion of the leaves of Tobacco (p. 308) operates powerfully upon the intestinal canal, whether administered internally or merely applied to the surface. It is not administered by the mouth as a purgative, although it is exhibited as a glyster in those cases which require the spasm to be resolved at the same time that the bowels are to be opened. With this view, it is frequently ordered as a glyster; but the remarks which may be offered respecting its effects in this form must be reserved until the subject of Enemas come to be discussed.

e. VERATRIA.

The chemical nature of this principle has been already explained. As a Cathartic, its chief influence is exerted upon the orifices of the common gall duct in the duodenum; whence a copious discharge of bile takes place, and the action of the intestinal canal is greatly augmented. It is the active principle of the Drastic Cathartic, Veratrum *album*.

1. Veratrum. *Veratrum.* L. *Veratrum album Radix.* D.—This root is a native of the Alps, Auvergne, Provence, and Dauphiny. Although perennial, it gives origin to an annual plant, which belongs to the natural order Melanthaceæ*. The root is a spindle-shaped, tuberculous, fleshy rhizome, about an inch in thickness at the summit, giving out, laterally, a great number of greyish fibrils. The stem, which rises four feet high, is composed of the long leaf-stalks of large plantain leaves, inclosed in one another. The flowers are in branching panicles, of a pale, yellowish green colour. In the dry state, and reduced to powder, the root of Veratrum operates as a powerful Drastic Cathartic. According to the analysis of Pelletier and Caventou, it contains—1, a fatty matter, involving an acid which has been named *Cevadic;* 2, an acidulous gallate of Veratria; 3, a yellow

* Woodville's Med. Bot. 3rd edit. p. 753, pl. 257. Richard, Hist. Nat. Med. t. i, p. 359. Hayne, xiii, 26. Lindley, 585.

colouring principle; 4, starch; 5, gum; and 6, lignine*. But, besides these, Simon has discovered two new bases, which he has named *Barylin* and *Jërvin*†.

If we compare the quantity of the salt of Veratria contained in the root of this plant with that in the cormus of colchicum, it is surprising that it has not been substituted for the colchicum on every occasion. The other components are fewer and less likely to be taken up with the salt of Veratria, whether wine or alcohol be used as the menstruum, than when the cormus of the colchicum is employed: it is also less likely to spoil, owing to its containing less water than in colchicum. In the root of Veratrum the active principle is the gallate of Veratria; and the only question is, how can this be most advantageously separated, so as to procure a preparation of a known and specific strength? One difficulty stands in the way; the gallate of Veratria cannot be obtained in a crystalline form; consequently it must vary in strength according to the quantity of water combined with it. As one of the salts of Veratria, however—the sulphate, for instance—is crystallizable, it might be tried as a purgative; and, if its powers be equal to those of the gallate, we should thus be enabled to procure a preparation of a specific strength. In mentioning the poisonous properties of Veratria, when treating of Colchicum, I stated that no antidote had yet been discovered; but on reflecting on the insoluble nature of pure Veratria, and the possibility of decomposing it, I am of opinion that an antidote may be readily found. We know that, although magnesia precipitates pure Veratria from the gallic acid with which it is combined; yet, too high a heat is required to effect this, to render it useful as an antidote; and it is a daily custom to prescribe magnesia in conjunction with the various preparations of Veratria without rendering them inert. M. E. St. Maire, of Lyons, has proposed tincture of Iodine as an antidote. Dogs, to which two grains of Veratria were administered, were saved on giving the tincture of Iodine immediately afterwards. Too little attention has been given to this subject, which is one of great practical importance. The root of Veratrum *album* is seldom employed as a purgative.

2. COLCHICUM. *Colchici Cormus, semina.* L. E. *Colchici autumnalis bulbus.* D.—This Cormus, and the plant which bears it, has been already fully described (p. 447). As a Cathartic, it operates chiefly upon the duodenum.

The Cathartic property of the wine of the seeds is equal to that of the wine of the Cormus. In doses of f℥i, it purges briskly, and produces great depression of power. When the dose is very large, the poisonous symptoms closely resemble those

* Ann de Chim. tome xiv, p. 81. Journ. de Pharm. vi, 363.
† Pharm. Central Blatt fur 1837, §191.

of malignant cholera. The lips become purple, the tongue pale and cold to the touch, and there is constant vomiting; but purging is not always induced. When death occurs, putrefactions occur early, and every viscus runs into rapid decomposition; but there are traces of the existence of inflammation or vascular congestion.

Sir Everard Home injected the wine of the Cormus into the veins of dogs. When the quantity exceeded two drops, it proved fatal. Both vomiting and purging were induced; and the post-mortem examination of the body discovered the mucous membrane inflamed, especially in the colon*. In experiments also made by Dr. R. Lewins, the same vascular state of the mucous membrane was observed†.

When the wine of Colchicum is administered in greater quantity than f℥iss in the course of the day, it causes nausea, increased secretion of bile, perspiration, turbid urine, and alarming depression of strength.

f. ELATERIN.

This is the active principle of Elaterium, and constitutes from 26 to 44 per cent. of its weight. Dr. Paris separated a substance which he termed *Elatin*, by digesting the Elaterium in strong alcohol, in a moderate heat, for twenty-four hours, filtering and washing the residuum with successive portions of fresh alcohol; then evaporating these alcoholic tinctures, and acting upon the extract with boiling distilled water. What remained undissolved was Elatin. I have found that a purer description of Elatin could be procured by digesting Elaterium in ether, and evaporating the solution on pure distilled water; the insoluble pellicle is pure Elatin: but Elatin is not a simple principle. Mr. Morris, of Stirling, and, nearly about the same time, the late Mr. Hennell, discovered that it consists of chlorophylle, in conjunction with a crystalline principle, which was named Elaterin. Mr. Hennell acted on the alcoholic extract of Elaterium with ether; the chlorophylle was taken up, and a substance left which was soluble in boiling alcohol, and which, on leaving the tincture at rest to spontaneous evaporation, crystallized in acicular tufts. This was Elaterin. It may be more cheaply procured by exhausting Elaterium with boiling rectified spirit, concentrating the tincture, as long as no separation takes place, and then pouring it into a boiling, weak solution of Potassa. The Elaterin crystallizes as the solution cools; the bitter principle and resin being left in the solution. The quantity of Elaterin in Elaterium depends on season, cultivation, and the mode of preparing the drug. The crystals of Elaterin are colourless, and devoid of odour, but intensely bitter; they are insoluble in water and in

* Phil. Trans. 1816. † Edin. Med. and Surg. Journal, vol. viii, p. 191.

diluted acids; but soluble in hot alcohol, hot liquor potassa, and slightly in ether; they are fusible in a heat between 300° and 400° of Faht.; burn in the flame of a spirit lamp, and leave much charcoal. They do not form neutral salts with the acids. They consist of 17 parts of carbon, + 39·2 of oxygen, + 23·9 of hydrogen, = 100·0*, or $C.^6$ $H.^{12}$ $O.^5$†.

The activity of Elaterin as a Cathartic is almost incredible. I have found that it operates violently when only one minim of an alcoholic tincture, consisting of one grain, dissolved in f℥ii of strong alcohol, is administered; hence it operates in doses of the one hundred and twentieth part of a grain. Elaterin has not, however, been employed in its pure state, even in the alcoholic solution, as a Cathartic.

ELATERIUM, *Elaterium*, L. E. D.—is a part of the juice of the fruit of the Momordica *Elaterium*, an annual plant which is a native of the South of Europe, but which is cultivated in England for medicinal use. It belongs to the natural order Cucurbitaceæ‡. The plant is a creeper, without tendrils, with cordate, somewhat lobed, crenate, rugose leaves, on long petioles. The fruit resembles a small oval cucumber, about an inch in thickness, an inch and a half in length, and is covered with thick, fleshy spines. When it is fully ripe, the fruit suddenly leaves the footstalk with great force, scattering the seeds behind it like the sparks from a rocket, as it flies forward§. The seeds, when fully ripe, are black, and are lodged in a light green pulp, the cells or interstices of which contain from half a drachm to a drachm of limpid fluid; and it is from this only that the Elaterium is precipitated.

The fruit is gathered before it is ripe, and, being cut longitudinally, the juice of the pulp surrounding the seeds is expressed with a gentle pressure, and is received into a fine hair-sieve. In the jar into which it runs from the sieve, it is allowed to remain at rest for two hours, to allow the subsidence of the fecula, which, after the aqueous portion is poured off, is put on a paper filter, placed on a cloth one, stretched on a frame: the dried pale green fecula forms the Elaterium of the Pharmacopœias. When the juice first flows out, it is perfectly limpid and

* Journal of Royal Institution, N. S. I. page 532. † Pereira.

‡ Woodville's Med. Bot. third edition, p. 192, pl. 72. London Dispensatory, art. Momordica. Hayne, viii, 45. Lindley, 86. Professor Richard has constituted it a peculiar genus, characterized by the separation of its fruit, and the scattering of the seeds from the orifice which is formed at the base of the fruit, when it leaves the peduncle, at the instant of its detachment: he has named it *Ecballium.*

§ The cause of the fruit spontaneously leaving the footstalk in the forcible manner which has been mentioned, and the scattering of the seeds often to the distance of several yards, is owing to the sudden contraction of its sides, when the pepo is greatly distended with juice. When it is nearly ripe, a gentle touch of the hand will cause its instantaneous separation; and from this circumstance the common appellation of the plant, *Squirting Cucumber*, originated: and also its specific name, Elaterium.

colourless; but it soon becomes turbid, and deposites the fecula. The Elaterium is most active when it is dried without exposure to the light. When genuine, it is in thin flakes, of a pale green colour, with a bitter, slightly acrid taste, which remains long upon the palate. It is nearly inodorous, although the plant, even in its dried state, has a peculiar aromatic odour. When Elaterium is much coloured, it is a proof that a mucilaginous matter, which is contained in the juice of the plant, has not been properly drained away. Much of the dark colour of bad Elaterium is owing to the same substance. It is sometimes, although rarely, adulterated with starch, which is not easily detected, and there is a large proportion of fecula in Elaterium; but when thus adulterated, it has almost a white colour, instead of a pale green; and when this is the case, there is reason for suspecting its purity. Maltese Elaterium is said to contain not only starch but chalk. The latter can be easily detected by its effervescing with acid*.

Much of the value of Elaterium depends on the manner in which it is prepared. It is best when the juice of the fruit is allowed to run out; for when the fruit is pressed, more of the inactive parts of the natural juice of the fruit is mixed with the Elaterium, which is consequently weaker in its action. The insolubility of the Elaterin in water suggests a query—what keeps it in solution in the juice of the fruit? Were I to suggest an opinion, it would be that Elaterin does not exist in the fruit, but is formed by the oxidizement of the fecula which subsides when the juice runs out of the fruit. It becomes turbid soon after it is exposed to the air; and the Elaterium loses much of its activity, or rather does not become so active, when it is dried in a bright sunshine, as when it is dried in the shade. Now, we know that light abstracts oxygen from substances containing it; as, for instance, from metallic oxides, which are partially reduced by exposure to light; and we also know that substances which would attract and combine with oxygen in the shade are prevented from doing so in a bright light; and, therefore, in this case, owing to the superior attraction of light for oxygen, the fecula may be prevented from obtaining its due share of oxygen; and, consequently, from undergoing the change of its constituents requisite for forming the Elaterin. The lighter, the more spongy, the paler the green, and the thinner the flakes, the more genuine is the drug; but when these are of a dark green or grey colour, or approaching to black, or when they are compact, heavy, and breaking with a shining, resinous fracture, they are not to be depended upon. The experiments of Dr. Paris, in which he was assisted by Dr. Farraday, authorized him to state that the chemical components

* I have a specimen of a dark-brown, viscid, semi-fluid Elaterium from Germany. It is of no value compared with the English drug.

of Elaterium are — *Water* 0·4, *Extractive* 2·6, *Fecula* 2·8, *Gluten* 0·5, *Woody matter* 2·5, *Elatin* 1·2, in 10·0 grains. But the quantity of Elatin, consequently that of Elaterin, must vary according to the circumstances already mentioned. The Elaterium often found in the shops is that imported from Malta. It seldom acts well under doses of a grain; and the black kind, which is prepared by evaporation of the expressed juice of the whole fruit, requires from two to four grains to act.

Although the term Elaterium is frequently found in the writings of the ancients, yet it is very difficult to determine what was exactly implied by it. Hippocrates applied the term to any violent purgative; but it is evident that he also knew and prescribed the plant which we have before us; for he mentions the Σικυς αγριος, under which name Dioscorides describes the Momordica *Elaterium* of our Pharmacopœias, and the method of preparing the juice of the fruit. The ancients used every part of the plant, both as an external application and an internal medicine, in dropsical affections; but the experiments of Dr. Clutterbuck ascertained that "no adequate substitute for the Elaterium could be found in the plant, exclusive of the fruit." Like many other medicines, Elaterium seems to have suffered in the estimation of the old physicians from the indiscretion with which it was prescribed. Simon Pauli speaks strongly of its violent effects; and, in addition to his opinion, Lister and Hoffman accused it of causing great heat and pulsation even to the ends of the fingers. Notwithstanding the opinions of the ancients, Elaterium has again been brought into general use; and, when properly managed, it is the best drastic Cathartic, not only for completely unloading the intestines, but for stimulating powerfully the intestinal exhalants, and causing a copious excretion of fluid from the bowels; and consequently emptying those cavities of the body in which serous fluid is apt to collect in dropsy. Sydenham employed it in dropsy with success. Dr. Ferriar, of Manchester, restored it to practice. He employed it very successfully in hydrothorax, in combination with colchicum, squill, and spirit of nitrous ether. In my own practice, I have given Elaterium in doses of from one tenth to one-sixth of a grain in combination with Calomel, repeated every six or eight hours, and have seen it evacuate two gallons of fluid, by stool, in the course of twenty-four hours. In such cases, it is necessary to support the strength of the patient, during its operation, with ammonia and camphor. Its administration, however, under every circumstance, requires caution, and the closest attention of the physician in watching its effects. I have found it the best means of reducing the circulating mass in hypertrophy of the heart. Elaterium has one disadvantage attending its action; namely, the nausea and vomiting which it almost always causes.

I am much in the habit of administering it in the form of Tincture, in which its action can be more controlled by the extent of the dose than when it is administered in substance. If the tincture be made with gr. i of Elaterium and f℥ii of Alcohol, the dose may be ♏.xii at first, and gradually augmented. The strength may be supported with Potassio-tartrate of Iron. It has occasionally been exhibited in the form of suppository; that is, it has been introduced within the rectum and left there. In this case, the dose may be one or two grains combined with hard soap. The dose of Elaterium may be from $\frac{1}{8}$ to $\frac{1}{2}$ of a grain.

The Dublin College has placed the leaves of Momordica Elaterium in the list of the Materia Medica. From what has been said, it is evident that no confidence can be reposed upon the use of any part of the plant, except the fecula of the fruit.

* * INORGANIC SUBSTANCES OPERATING AS DRASTIC CATHARTICS.

Oxysulphuret of Antimony. *Antimonii Sulphuretum.* L. *Antimonii Sulphuretum aureum.* E. *Antimonii Sulphuretum fusca.* D.—This preparation (p. 748) is a component of the following pills.

Compound Pills of Chloride of Mercury. *Chloridi Pilulæ Hydrargyri compositæ.* L. *Pilulæ Calomelanos compositæ.* E. D. Triturate together ʒii (*one part*, E. D.) each of Chloride of Mercury and Oxysulphuret of Antimony; ℥i (*two parts*, E. D.) of Guaiacum in fine powder; and ʒiii (two parts, E. a sufficiency, D.) of Treacle, till a uniform mass is obtained (to be divided into six-grain pills, E.). It possesses more diaphoretic than cathartic properties. The dose is gr. x to ℈i, to relieve constipation. But it must be recollected that the propriety of administering Cathartics to relieve constipation depends altogether on the cause of that torpidity of the intestinal canal. It may depend upon simple torpor, in which case they are proper; but if inflammation be present, they will only augment the danger.

D. CLYSTERS.—ENEMATA.

These consist of cathartic substances largely diluted and injected into the rectum.

The intimate relation between every part of the alimentary canal, and between it and the system in general, enables some medicines to operate nearly in a similar manner, whether they be taken into the stomach, or injected into the intestinal canal, or applied to any part of the denuded surface. In many instances, the stomach is in such an irritable state, that it rejects all kinds of medicines; in other instances, large quantities of medicines are occasionally taken by the mouth without producing any effect; in others, again, deglutition is impeded by lock-jaw, apoplexy, or similar causes. In all these cases, injections or

Clysters, *Enemata,* may be resorted to; and they greatly aid the operation of Cathartics, by exciting the peristaltic movement of the larger intestines.

In habitual costiveness, arising from a torpid condition of the bowels, a pint of cold water, thrown daily into the rectum, not only excites the natural peristaltic movement, but imparts tone and activity to the entire gut. A table-spoonful of common salt, or of castor oil, augments the cathartic influence of this Clyster; but if the constipation be obstinate, or attended with flatulent colic, and an effective operation be required, what is termed the terebinthinate clyster (℥ss, D.) is generally employed. This is made by triturating about *an ounce (Enema Terebinthinæ,* L. E. D.) of turpentine with yolk of egg or mucilage of gum, and adding a pint of water: half that quantity of infusion of senna, if it be necessary to stimulate more briskly the lower bowels, may be ordered, with half a pint of water. All the purgatives and drastic Cathartics, combined with any bland fluid, may be employed as Clysters; infusion or decoction of senna, combined with any of the saline purgatives, are the usual kinds of Enemata in ordinary cases. Even hot water, in sufficient quantity to stimulate by distension, often answers every purpose which can be desired from the use of Clysters. Infusion of tobacco is frequently employed. Tobacco, when applied to any mucous membrane, stimulates powerfully; but, when thrown into the rectum, either in infusion in water or in the form of smoke, it operates chiefly on the nervous system, relaxing spasm; and diminishing, almost instantaneously, all the powers of life; and, not unfrequently, its sedative influence has been productive of death. The strong aqueous infusion paralyzes the heart and quickly destroys life; the essential oil contained in the smoke excites convulsions and coma, without affecting the heart; but it proves equally fatal. Both act on the nervous system. Dr. Macartney, of Dublin, has confirmed the observation of M. Orfila, that, like other violent poisons, they are inert when applied directly to the denuded brain or nerves. But this affords no argument against the opinion that they operate through the medium of the nerves; since there is a great difference in the effect of an impression made upon a nerve in any part of its course, or at its origin in the brain, and its sentient extremities.

The quantity of the tobacco ordered by the Pharmacopœias for making the infusion is one drachm to one pint of water; but its power depends very much upon the quality of the tobacco; and something upon the habit of the patient. I have seen cold sweats, the most alarming sinking of pulse, and syncope, caused by one-half the quantity which I have mentioned Indeed, such is the risk attending the employment of the tobacco Clys-

ter, that nothing but the failure of every other means of relief can authorize its employment. Besides the infusion, the smoke of tobacco is thrown into the rectum, with the view of overcoming obstructions similar to those which require the employment of the infusion; and certainly much less risk is likely to result than from the infusion: its efficacy, however, is less certain. A particular apparatus has been invented for exhibiting tobacco fumes as a Clyster; but every practitioner should, if possible, be independent of these *useful* inventions, which are not always at hand, and the absence of which ought not to prevent the employment of a useful remedy. The machine alluded to is a double bellows with a box interposed between its body and the nozle, for putting the lighted tobacco in, so that the stream of air passing through it carries the smoke of the ignited herb into the rectum. When this machine is not at hand, its place may be supplied by a common-clay tobacco pipe, the small end of which being oiled and introduced into the rectum, and a piece of cloth held over the mouth of the bulb holding the ignited tobacco, the smoke may be blown by the breath of an attendant into the bowels of the patient. It might be supposed that the breath, being chiefly carbonic acid gas, would extinguish the tobacco; but this is not the case, the quantity of nitre in the herb being sufficient to maintain its combustion, independent of the atmospheric air, or any gaseous supply of oxygen.

Much of the inefficacy of Clysters, in many instances, arises from their not being of sufficient bulk; and from their not being injected with sufficient force to reach the obstructed part of the canal, even when urged by the usual apparatus for exhibiting them; indeed, they seldom pass far beyond the sigmoid flexure of the colon: they operate, therefore, by exciting the lower portion of the bowels, and produce merely partial discharges; for although there is a general sympathy of action in the whole intestinal canal, in its healthy state, yet this has not much influence in those diseases which are accompanied with obstinate obstructions of the bowels. Clysters are more effectually administered by means of the stomach pump; by apportioning the force of which, the fluid may be conveyed to any part of the intestinal canal.

With regard to the proper bulk of Enemas for different ages—the usual quantity for an adult is a pint of fluid; that for an infant, not more than three fluid ounces; so that, between these two points, taking into consideration the size of the individual, the quantity proper at different ages may be readily determined. If too much fluid be employed, the Clyster acts by its bulk, rather than by the stimulus of the material; the reaction of the gut upon its foreign contents is too quick, and the object of

the prescriber is defeated: on the other hand, if the quantity be too small, it remains too long in the bowels, and often fails altogether to excite their action.

Besides Cathartics and Enemas, the peristaltic motion of the bowels may be increased by various external means. Thus, in simple torpor of the gut, the electrical aura is highly useful; and, in obstinate costiveness, when all other means have failed, dashing cold water on the lower extremities has succeeded in procuring the immediate evacuation of the intestines.

THERAPEUTICAL EMPLOYMENT OF CATHARTICS.

Having completed our examination of the substances usually employed as Cathartics, it now only remains to advert to their practical employment in the treatment of diseases.

Purgation is a physiological phenomenon, which involves the action of a certain number of secerning and exhaling organs, producing more abundant excretions than usual in the intestinal canal, and repeated alvine evacuations. This mode of viewing the influence of this class of medicinal agents, sets aside the idea of the bowels being the common emunctory of all peccant humors. Nevertheless, some practitioners employ Cathartics as if they were proselytes to that belief—they treat all diseases with purgatives; profess to have no confidence in any other medicines, and, in truth, purge without end. A more correct knowledge of Pathology leads to a more rational employment of Cathartics in the treatment of diseases.

The symptoms, independent of the existence of specific disease, and exclusive of a confined state of the bowels, which indicate the administration of Cathartics, are—a whitish, yellowish, or blackish tongue: dryness of that organ, and any unusual taste in the mouth; fulness of the lower belly, with or without tenderness on pressure; the urine saffron-coloured or loaded with bile; and fluid dejections, with borborygmi.

The following ought always to be kept in recollection:—

The *First* of our general intentions of administering purgatives is to clear the intestinal canal; for which purpose they must be given in full doses, and those selected that will act on the whole course of the canal; namely, castor oil, or a combination of tartrate of potassa and infusion of senna.

The *Second* is to correct unhealthy secretions; and this is to be effected by calomel or the blue pill, given at bed-time, followed by a purgative in the morning. The symptoms indicating this practice are a whitish slimy-coated tongue, the white of the eye suffused with yellow, and the skin dry, harsh, dingy, and sallow.

The *Third* is to augment the discharge from the intestinal exhalants, so as to lessen the bulk of the circulating mass, and to

lower excitement; which are best accomplished by small repeated doses of neutral salts: for instance, from ʒss to ʒi of Sulphate of Magnesia, repeated at the distance of three or four hours, for several successive days. And it is important to recollect, that, in many instances, purgatives debilitate as much as blood-letting.

The *fourth* is the lessening the determination of blood to particular parts, by employing such purgatives as will operate by counter-irritation.

Without entering into the controversy whether fever be exclusively connected with the solids or the fluids of the body, there can be only one opinion respecting the utility of purgatives, judiciously prescribed, in febrile diseases. Their liberal employment in fevers has been, in numberless instances, followed by the most decided benefit; nevertheless, their exhibition in these diseases requires the greatest discrimination.

It was the practice of the physicians of former times to delay the administration of Cathartics until the decline of continued fevers; in order, as they imagined, that the morbific matter should be concocted and rendered proper to be expelled. The experience of modern times has demonstrated both the fallacious reasoning and the impropriety of the practice of our ancestors in this respect.

The dread of debility long stood in the way of purgatives being prescribed in fevers, until Dr. Hamilton, of Edinburgh, demonstrated " that while purgatives preserve a regular state of the body, they do not aggravate the debilitating effects of fever." Indeed, the complete and regular evacuation of the intestinal canal, in the course of fever, is a most desirable object: although it is equally important to avoid the employment of such Cathartics as will produce watery stools; as these are not only unnecessary, but tend to increase debility. " Within such a limit," says the experienced physician already quoted, " I have had much satisfaction in prosecuting the practice; nor have I, in a single instance, had occasion to regret any injury proceeding from it; for I am not an advocate for exciting unusual secretion into the cavity of the intestines, and for procuring copious watery stools: these, while they are not necessary, might increase the debility so much dreaded*." In taking this advice as our guide, we must be certain of the condition of our patient; for it occasionally occurs that accumulations take place when both the patient and the nurse report that the bowels are freely opened:— not to purge in this case might be injurious; but, in satisfying ourselves of its necessity, the purgative must be such as will act fully, and will fairly clear the intestinal canal. On the contrary,

* Hamilton on the Utility and Administration of Purgative Medicines in several Diseases.

when unhealthy secretions, pain, tenderness, and flatulence, do not soon yield to purgatives, their employment should be discontinued; as these symptoms, instead of being removed, are sometimes kept up by the use of the Cathartics. The physician who purges indiscriminately in continued fever, and expects that the patient can profit by this practice, relies on a vain delusion. This view, however, of the safety and value of purgatives in fever refers chiefly to the early state of the disease; in the more advanced stages, the propriety of their employment is doubtful, if it be not altogether injurious. In that period of the disease, if vitiated secretions be required to be carried out of the bowels, mercurials in small doses, followed by mild aperients, should be employed; but much depends on the particular circumstances of each case. When they are indicated, in the commencement of the disease, and much excitement is present, Calomel, combined with Rhubarb, or Tartrate of Potassa with Infusion of Senna, may be administered. When there is a tendency to gastric irritation, the ordinary aperients are rejected; and, indeed, they are often, under such a condition of the stomach, contraindicated. But should they be requisite, none of the class is so likely to allay the irritable state of the stomach, and, at the same time, to purge freely, as the Sulphate of Magnesia, disguised in the Infusion of Roses, acidulated with diluted Nitric Acid. In this case, also, enemas are adapted for relieving the large intestines; and it generally happens that the movement thus communicated to the lower part of the canal is propagated to the upper. When cerebral symptoms display themselves, purgatives are the means upon which we must chiefly rely, if other circumstances of an important character do not intervene to forbid their employment.

When continued fever assumes the typhoid character, the propriety of using purgatives will altogether depend on the condition of the bowels; whilst, at the same time, that we must guard against any intestinal accumulations, we must employ the mildest means of removing them; Castor Oil, or small doses of Hydrargyrum cum Creta with Rhubarb, are the best purgatives under such circumstances. But, in the commencement of the disease, experience has taught me the vital importance of thoroughly evacuating the bowels, whilst the vigour of the habit enables us to do so with impunity. No rule, however, is more properly imperative than that which condemns indiscriminate purging in typhus: even in the commencement, if the frame of body of the patient be delicate, it applies: and it is in such a case that it is followed by languor, sometimes syncope, and a train of other untoward symptoms. It is requisite, also, always to bear in recollection the fact, that inflammation of the mucous follicles, and even of the entire membrane, is one of the sym-

ptoms very likely to occur in typhus; and, consequently, that every cause of irritation, whether gastric or visceral, should be sedulously avoided. When the abdomen becomes tense and drum-like, or tympanitic, purgatives may increase the evil: and even although carminative enemas afford temporary relief, yet, it is only transitory: the fœtid gums are frequently used for this purpose. In my own practice, having ascertained that the gas extricated in this condition of the abdomen is chiefly Sulphuretted Hydrogen, and the experiments of Majendie and Chevreul having also detected Carbonic Acid and Carburetted Hydrogen Gases, with some Nitrogen, and that these gases exist chiefly in the colon and rectum, I have found that they are more easily dislodged by enemas than by purgatives. To the powerful sedative influence of sulphuretted hydrogen, much of the depression of the vital energy experienced in this state of the bowels is due. I have generally ordered Infusion of Rhubarb with Chloride of Soda in solution to be administered per anum, and have rarely failed of affording the greatest relief to the patient. In this case, the Hydrochloric acid which results, from the combination of the Chlorine and the Hydrogen of the gas, operates as a salutary tonic to the debilitated intestines; whilst the Sulphur which is precipitated is partly absorbed, partly ejected from the bowels in the evacuations that follow. The fœtor of the alvine discharge is immediately destroyed; a circumstance which adds greatly to the comfort of the sick-room.

In that form of continued fever, which is named Epidemic gastric fever, or gastro-enteric, purgatives require to be administered with much caution. This form of fever is characterized by general restlessness, a most unpleasant state of the mouth, a taste which is described as intolerable, but cannot be described in words: heat of skin, often tenderness in the epigastrium; redness of the fauces, and an aphthous tendency in the mouth. From the disagreeable state of the mouth, purgatives have been often injudiciously pushed in this fever. Now, it is of importance to know the points that contraindicate their employment: in the first place, they ought not to be administered when, on examining the outline of the abdomen, we find that the ribs are elevated and the belly soft; in the second place, when nausea and sickness are present, with the tenderness of the epigastrium; and, thirdly, when the egesta are serous or mucous, or are rendered so by a purgative. If these symptoms be not present, and purgatives are required to relieve the bowels, the mildest should be selected—namely, Phosphate of Soda, or Rochelle salts, or Magnesia washed down with lemonade, so as to form the Citrate of Magnesia;—or Sulphate of Magnesia in doses of ʒss to ℥i, in the Infusion of the Conserve of Roses, acidulated with sulphuric acid. If the stools display a deficiency of bile,

small doses of blue pill may be given at bed-time, in combination with a grain or two of powder of Ipecacuanha; and followed, in the morning, by any of the mild aperients already mentioned.

In *Intermittents*, purgatives may be more freely prescribed than in any form of Continued fever; nothing but an uncommon prostration of strength forbidding their employment: on the contrary, they aid the influence of antiperiodics. In saying this, however, reference must be had to the kind of purgatives employed, as it is by no means unfrequent to find that a violent drastic cathartic will convert a tertian ague into a quotidian; and give the continued form to the latter. In all cases, the mild mercurial preparations, given at bed-time, and followed by a saline draught, are to be preferred; and, from the almost constant tendency which accompanies Intermittents to derangements of the biliary organs, the repetition of this kind of purgative is necessary, before commencing the administration of antiperiodics. In warm climates, there is generally a greater derangement of the biliary organs than in cold climates; and therefore Cathartics are more required in agues. In cold climates, season makes a difference: autumnal agues require more purging than those of spring, owing to the derangement of the biliary organs which then occur. With respect to the period of the disease—they certainly ought not to be given so that their operation shall occur in the cold stage of the paroxysm, which they always protract by weakening the powers of reaction; and they are equally inadmissible in the sweating stage, as they tend to cut this short, and to change the intermittent to the remittent type. In the hot stage, they are indicated when there is much oppression at the præcordia, and a determination to the head: but the time to administer them with least hazard is during the apyrexia or intermission. The symptoms indicating their use in intermittents, are, much arterial excitement, great derangement of the abdominal viscera, headache, and dyspeptic feeling. It has been asserted that inflammation of the mucous membrane should not prevent the employment of purgatives in Intermittents; at least, such as neither tend to induce nor to aggravate this condition of the alimentary canal; but this is a doctrine to which I cannot accede. In no instance can it be requisite to irritate with purgatives so important an organ as the gastro-enteric tunic of the intestinal tube, when suffering from inflammation, or in a highly irritable state. On the contrary, experience has taught me that the best aid to the salts of Quina, in such cases, is Dover's powder, or a combination of Ipecacuanha and Opium. The division of the Cathartics best suited for intermittents, is that of Purgatives—for example, Calomel and Rhubarb; but if they are required merely to regulate the bowels, nothing answers better than Aloetics. In prescribing Cathartics, however, in intermittents, it should be recollected that, as agues are diseases of depression of strength, much purging

is always injurious; for, when the disease is yielding to tonics, the exhibition of a brisk Cathartic will often renew the paroxysm in all its original violence, and render the subsequent treatment more difficult, and the disease more protracted than it would have otherwise proved. This is an observation which was made by Sydenham and De Haen; and it has been confirmed by the experience of every subsequent attentive observer.

In *Remittent Fevers*, the too free administration of purgatives is greatly to be reprobated. They are required merely to unload the bowels; therefore they should be of a moderate strength, and frequently repeated, rather than of a drastic nature. A combination of Plummer's pill and Aloës, in the proportion of six grains of each, is fully adequate to answer every intention.

In *Infantile Fever*, the deranged condition of the alimentary tube indicates a more free use of purgatives. I have found the best results from the administration of full doses, namely, from gr. iii to gr. v of Calomel, followed by Senna and Sulphate of Magnesia, necessary in the commencement: and the repetition of small doses of Calomel, with Dover's powder, at bed-time, for some days afterwards. In this fever, the sensorial functions are greatly oppressed, and often threaten Hydrocephalus. In such cases, Dr. Cheyne judiciously recommends a pill of Calomel and James's powder, interposing between every second and third dose a common purgative draught. But the purgative plan of treatment may be carried too far in Infantile as well as in adult Remittent fever. By too free use of Cathartics, the tone of the intestines is weakened, and tympanitis may be induced: where that is threatened, Hydrargyrum cum Creta, with Dover's powder, and small doses of Rhubarb, are sufficient to keep the bowels gently open; whilst the system is to be supported by proper tonics.

In *Hectic*, my experience has made me dread the administration of even the mildest description of purgatives.

In *Puerperal Fever*, after bloodletting, and the administration of two or three large doses of Calomel, James's powder, and Opium, much benefit has been ascribed to the exhibition of oil of Turpentine, combined with Castor oil, or some other purgative: but I am much disposed to accord with Dr. Clarke, Dr. Robert Lee, and others, on this side of the Irish Channel, that the internal use of Turpentine, either in the superficial or deep-seated inflammation of the uterus, is to be deprecated. Without the addition of the oil of Turpentine—the Castor oil, or even the ordinary black draught, may be advantageously used after a second dose of ten grains of calomel, with four or five grains of James's powder, and two of opium. Dr. Lee says—"after the operation of this purgative, in some cases, the pain of the uterus, which had been only relieved by the bleeding and the Calomel, has completely subsided."

In the *Yellow Fever* (that awful counterpoise to the destructive ambition of conquerors, before whose baneful breath so many of our bravest countrymen have fallen victims, in that death-bed of British valour, the West Indies), much diversity of opinion exists, among those best fitted to form an opinion on the subject, respecting the utility of purgatives. I believe that in those cases in which excitement runs high, and vomiting is severe, instead of the large doses of Calomel and Jalap, or other drastic purgatives, which were formerly given, a drop or two of Croton oil placed upon the tongue answers every intention, without, in any degree, augmenting the irritability of the stomach. It may, also, be exhibited in the form of enema, to the extent of three or four drops. It allays the great irritability of the stomach, and brings on a nearly perfect remission. The power of the Croton oil in allaying irritability of the alimentary canal, is, indeed, very surprising. In a disease in which the stomach is in a very irritable condition, it is easy to conceive that enemata may prove a valuable mode of administering purgatives, and experience has displayed this to be the case. In some instances their administration has been found impracticable, from distressing excoriations around the anus, so that here again the value of the Croton oil is exemplified.

Let us now examine into the utility of purgatives in those varieties of fever which are accompanied with cutaneous eruptions, in which the close sympathy between the skin and the intestinal canal suggests the advantages to be derived from purging.

In the phlegmonous variety of *Erysipelas*, active purging has proved useful: and, in cases which are little benefited by bloodletting, mild purgatives have answered every intention. But when the fever assumes a typhoid type, accompanied with delirium or coma, when the colour of the eruption is dark-red, and the vesications assume a livid hue, they must be prescribed with great circumspection: instead of cathartics, along with the employment of Cinchona and the mineral acids, opium and wine, the mildest aperients only are admissible.

In *Measles*, the improper use of purgatives too often causes a retrocession of the eruption; in the same manner as diarrhœa setting in at the commencement of the disease produces this effect. If, along with tenderness at the epigastrium, the alvine discharges are of an unusual colour and fœtid, Calomel and Rhubarb, and afterwards an anodyne injection, may be proper.

In *Scarlatina*, no remedies are more serviceable than purgatives, when they are administered with judgment; nevertheless, the dread of debility, and of throwing in the eruption, as its disappearance is termed, have deterred many from the administration of purgatives. The symptoms indicating the use of purgatives, are, pungent heat of the skin, violent headache, turgescence of features, and a full and quick pulse. In the subsequent periods of the disease also, purgatives are useful for securing the com-

plete and regular evacuation of the bowels, and to prevent accumulations in them, which never fail to aggravate all the symptoms. In the early stage, when there is nothing to contra-indicate purging, a mild aperient may be given every day; such, for instance, as two or three grains of Calomel, with six or nine grains of Rhubarb, at bed-time, and Castor oil, or the common black draught in the morning. Mild aperients are as requisite during desquamation. If the mucous membrane be highly irritable, they should not be employed: indeed, as diarrhœa is then generally present, the mildest purgatives may do harm: if any be indicated, Castor Oil, suspended in mucilage of gum, with a few drops of T. of Opium should be preferred. In the Dropsy, which often succeeds to the decline of the eruption, purgatives prove decidedly beneficial; and in my hands they have displayed much more efficacy than bloodletting, or diuretics.

In the commencement of *Small-pox*, the bowels should be relieved, but not by drastic purgatives; during the period of maturation, also, they require to be daily regulated by such mild substances as will not give more than one, or at the utmost two, motions in twenty-four hours. In the decline, when the disease has been mild, a few doses of some gentle purgative is requisite to keep down feverish excitement, and to remove foul secretions: when it has been more severe, Calomel and brisk purging are requisite; Calomel and Rhubarb, and Salts and Senna, are the purgatives that answer best in such cases.

In *Gout*, the value of purgatives is undoubted, and to this property some specifics, as they are termed, owe all their celebrity; it is to their effects on the bowels that all is due. But the student who is informed that gout was formerly cured solely by purgatives, will naturally enquire, why was the practice set aside? The only reply is, that the authority of Sydenham enslaved the minds of his followers; and, for nearly a century, physicians, misled by a name, abandoned the disease to itself. This great physician conceived the idea that it was an inviolable law of Nature that diseases should be thrown off by the extremities; hence, in gout, he forbade the use of cathartics—" nisi ut materia peccans," says he, " quam Natura in corporis extremitates protruserat, in sanguinis massam denuo revocetur :" an opinion purely hypothetical, and now happily exploded. Gout is a disease of depraved digestion: to relieve it, the most complete evacutations of the whole alimentary organs are essential. When the inflammation is high, with a strong bounding pulse, hot skin, and loaded tongue, the influence of a purgative displays itself forcibly in the relief which follows. The best purgative is Colchicum, which not only purges, but combines with its aperient, sedative properties. I am of opinion that it rarely relieves unless it purges freely. The motions which it produces are copious, watery, and bilious; and where plethora is present,

after bloodletting, its action seems to remove much of the overload of the circulating mass. In my opinion, also, it is preferable to administer it in full doses, than in frequently repeated small doses; namely, in f℥i of the wine of the seeds, night and morning, until it purge freely; and then it may be continued in smaller doses. When it meets with much acid in the stomach, it passes too rapidly through the duodenum, and glides over the orifice of the gall ducts without stimulating them; it, therefore, does not purge; and, on this account, the addition of magnesia is requisite. The idea of regarding the benefit of Colchicum to depend on its purgative power, is considered as an error by some practitioners, who suppose that it is most useful when it does not pass off by the bowels; or, in other words, they value it for its sedative, not for its evacuant, properties. I must again say, that my experience does not permit me to accord with these opinions. I do not deny that it is a narcotic as well as a purgative; but it is to the latter influence chiefly that its use in Gout is due; and I have never seen any reason, except in very weak habits, for relinquishing it on account of its purgative properties.

The same remarks apply with respect to the use of Colchicum in acute Rheumatism. In the chronic form of the disease, purging is more requisite than in the acute. Indeed, the alliance between Gout and Rheumatism is so close, that the treatment beneficial in the one disease is applicable to the other. Purging in Rheumatism is a very ancient practice; and we find Colchicum, under the name *Hermodactylus*, was the purgative employed by the ancient physicians. In proportion as fever is present, will the free use of purgatives be required; and saline Cathartics should be employed in aid of those which more peculiarly deterge the mucous membrane of its morbid secretions; and as long as these remain dark coloured, slimy, and unnatural, must purgatives be continued. Calomel, Antimonials, and Scammony, are the most effectual means of purgation in such cases. In some other painful neuralgic affections, especially *Tic-douloureux*, purgatives have also been found useful. Dr. Newbigging, of Edinburgh, led by the cures which he had witnessed by M. Lerminier, of Paris, employed Croton oil in various nervous affections, and with the most salutary effects*. He is of opinion, however, that the beneficial action of the oil is not solely due to its purgative, but partly to some specific, influence which it exerts on the nervous system: and this opinion is also that of M. Andral†.

In diseases of the digestive organs and the abdominal viscera, it is scarcely necessary to say that purgatives are clearly indicated.

In *Gastritis* and *Enteritis*, notwithstanding the dread of our

* Edin. Med. and Surg. Journ. vol. lv, p. 100. † Clinique Medicale, vol. i.

Continental brethren, purging after bloodletting is necessary. Besides removing hardened fæces, and other irritating substances that keep up inflammation, purging, by augmenting intestinal exhalation, unloads the vessels and relieves the disease by the same process that Nature adopts. In such cases, however, purgatives should not be administered by the mouth; but, when purgation is requisite, it must be procured by *Enemata:* and these should not be stimulating, but only gently laxative. In the Enteritis of children, a correct diagnosis is of great importance, as the disease is often mistaken for worms; and thus, at least as far as concerns purgatives, it is most improperly treated. When the attack arises from indigestible food, purgatives in the commencement are indicated: but after the bowels are unloaded, although the symptoms continue unaltered, yet, in such a case they prove injurious. And here I must again remark, that the system of indiscriminate purging is the opprobrium of British practitioners: and I concur in a censure of Dr. Stokes, "that, since the writings of Dr. Hamilton and Mr. Abernethy, too many practitioners have had, in the treatment of digestive derangements, but two objects in view, namely, giving doses of purgative medicines, and noting the quantity and quality of the fæcal discharges; whilst the gastro-intestinal surface, that prodigious musculo-nervous expansion, has been wholly unheeded and forgotten."

Cathartics are generally administered in dysentery. When the intestinal inflammation is not preceded by diarrhœa, the contents of the bowels acquire an acrid character, and require to be removed: in effecting this, however, we must recollect the inflammatory state of the colon and rectum, and employ Castor oil, or even milder purgatives, as soon as a little respite from pain has been obtained by bleeding. Drastic Cathartics augment the tendency to tenesmus, the most distressing of its symptoms.

In that state of the stomach which constitutes *Atonic Dyspepsia,* the stomach is improved by exciting, to a certain extent, the action of the bowels. Rhubarb is the best purgative in this case; it may be combined with Carbonate of Soda, or with an Aromatic, or the wine of Aloës, according to circumstances. In this form of Indigestion, both Senna and the saline purgatives are improper.

In *inflammatory gastric Dyspepsia,* although, as a general rule, the bowels should be relieved by enemata, yet, when the hepatic secretion is in fault, small doses of the Hydrarg. c. Creta at bed-time, and moderate doses of Castor oil in the morning, will be found beneficial. When there is more irritability than inflammation of the digestive organ, it is of importance to procure easy and satisfactory relief of the bowels; but this ought to be obtained by the aid of the least irritating means: a mild

Aloëtic pill, or the simple cold water Clyster, will be found sufficient.

In the *follicular form of gastric Indigestion*, the bowels require more attention than in the other varieties: the best aperients are the compound decoction of Aloës combined with alkalies or lime water; or pills consisting of Aloës, Rhubarb, and Galbanum, or the precipitated Sulphur.

In that form of Indigestion which is referred to the duodenum, and consequently named *duodenal*, purgatives are directly indicated. For emptying the duodenum, Dr. W. Phillips says that Senna more effectually removes the fulness of the right Hypochondrium, when it depends on the morbid distension of the duodenum, than any other mild purgative. It answers best when it is combined with Tartrate of Potassa, which aids its *purgative* and lessens its *griping* properties. In general, there is no necessity to precede the purgative by a dose of Calomel; Mercurials are more necessary after the bowels have been evacuated. Much inconvenience in convalescence from this disease depends on the torpid state of the alimentary canal. To correct this, it is of importance to select a purgative that will not lose its power when used for some time; Aloës is admirably adapted for this purpose: it may be combined with Rhubarb, Gentian, Soap, Guaiacum, Ipecacuanha; or, if flatulence be very troublesome, with the compound Galbanum pill; or the Extract of Chamomile flowers; or Sulphate of Potassa. But all artificial aids of this nature should be discontinued as soon as possible. In the follicular form of this variety of dyspepsia, purgatives are indicated, as they exert a particular influence upon the function of the mucous follicles. A combination of the Infusion of Senna with Infusion of Gentian, and from m. x to m. xx of liquor Potassæ, form an excellent remedy in this variety of the disease: it should produce from four to five stools daily; and, in operating in this manner, it discharges the flakes of morbid mucus better than saline purgatives or mercurials. When there is much torpor of the system, with coldness of the surface and much pale urine and dark mucaginous stools, Dr. Yeats recommends, very strongly, f ʒi of the Vinum Aloës, with m. xv of Liquor Potassæ, in f ℥iss of Infusion of Chamomile flowers, every morning; and to be steadily persevered in for a considerable time. The effects of this combination must be closely watched: if it cause thirst, heat, or much griping, it should be discontinued. Purgatives are rendered more efficacious in this disease by prefacing their use with a short course of alteratives: the blue pill, in doses from gr. i to gr. ii, is generally sufficient: it may be combined with either the compound Galbanum pill, or with Ipecacuanha and Opium.

When the larger Intestines become torpid, and pain is experienced in some part of the colon, constituting what has been

termed *Atonic Colonic Dyspepsia*, the indications to be fulfilled are—1, to remove all accumulated fæces from the bowels: 2, to promote the regular function of the gut; and to correct its morbid condition, if this can be ascertained. Purgatives are adapted for fulfilling the first of these indications; but they are not to be administered with an unsparing hand. Rhubarb, Sulphate of Potassa, and a little powdered Ginger; or the compound powder of Scammony, followed, after a proper interval, by a small dose of Infusion of Senna, are the best description of purgatives for Atonic Colonic Indigestion.

In diseases of the other abdominal viscera, their administration requires much consideration: thus, when the liver is oppressed with an excess of bile, purgatives are productive of the most salutary effects; but when it is suffering under inflammation, they augment the excitement and produce mischief. In indurations of its tissue, also, purgatives, in small and frequently repeated doses, prove beneficial and permanently useful, whilst, in hypertrophy of the organ, even when they evacuate much bile, only trivial and momentary relief follows their employment.

In *Chronic Hepatitis*, the bowels should be regularly but gently acted upon by mild purgatives combined with mercurials.

In Jaundice, Cathartics have been employed to remove local obstructions to the flow of the bile into the duodenum; and to stimulate the liver to increased action, as far as regards the secretion of bile, when this is deficient. By stimulating the orifice of the common duct, and at the same time augmenting the natural movements of the intestines, they convey a new excitement to the duct, which enables it to force forwards any calculus or inspissated bile in it, and thus to aid its expulsion. With respect to the Cathartics proper for this purpose, calomel is almost invariably selected. It has a powerful influence on the duodenum; and, in conjunction with aloetics, is perhaps the best that can be employed in jaundice. But the bile is often prevented from passing into the intestines by the condition of the intestines themselves, independent of inspissated bile or calculi. This is particularly the case in young patients, in whom the obstructing cause is not unfrequently a viscid state of the secretion of the duodenum, arising from a deficient secretion of pancreatic fluid to stimulate its glands. In some cases, even foreign substances, passing undigested from the stomach, act as the obstructing causes. In all these instances, Cathartics are the best remedies; and, even when scirrhus exists, or the common duct is obliterated by cohesive inflammation, Cathartics are still indicated for relieving the obstinate constipation which always accompanies a deficiency of bile in the intestinal canal. In this state, the best Cathartic is aloës; not because it is bitter, and may supply the defect of bile, but because its cathartic ope-

ration is always followed by a lax state of the bowels. It is a curious effect of the repetition of calomel in some habits, that it causes white stools. It has been supposed that, in such cases, where jaundice is present, that gall-stones previously exist in the gall-bladder, and that the stimulant influence of the calomel on the orifice of the common duct brings them down from the bladder into the duct: but were this the case, other purgatives, which also stimulate the gall-ducts in their passage through the duodenum, should produce the same effect; which, however, is not the case. I am, therefore, inclined to think that this effect of calomel depends upon some other cause not yet ascertained.

In *Calcular Jaundice*, the bowels are sometimes in a relaxed state; in other cases they are obstinately costive, and require strong and repeated doses of purgatives, namely, Calomel in combination with Colocynth and Aloës; and, even after the Calculus is expelled, the use of purgatives should be continued until the chylopoetic organs regain their tone and natural function. In my own practice, I have found the administration of gr. iv to gr. v of Blue-pill at bed-time, with a draught composed of f℥i of decoction of Aloës, f℥ss of Infusion of Senna, and from fʒss to fʒi of Liquor Potassa, taken on the following morning after the pill, and continued steadily for some time, rarely fail to relieve this condition of the intestinal canal. This practice is also applicable to those cases in which a diseased condition, either of the liver or some neighbouring part, is suspected.

In *acute inflammation of the Heart* or its covering, Purgatives are not directly indicated, and they are only employed as a part of the antiphlogistic plan of treatment. In *Hypertrophy*, when the action of the heart increases, and yet general bleeding is not expedient, the bowels should be acted upon by brisk saline purgatives, so as to obtain four or five copious watery stools daily: and this continued for a week. The bowels should also be habitually acted upon; but, with the view of preventing the general debilitating effects of continued purgation, some bitter tincture and diluted sulphuric acid should be added to the purgative. I have lately found that Calomel and Elaterium, in combination, are the most beneficial mode of diminishing both the quantity of the circulating fluid, and lessening the heart's action in Hypertrophy. The diminished quantity of the blood, being produced at the expense solely of the serous portion of it, without diminishing the *albumen* and the *fibrin*, does not weaken the powers of life so much as when the lancet is employed. It is on this account that the temporary debility which follows the use of Elaterium is so rapidly recovered from. This combination, by improving the secretions, is much less likely to weaken the digestive organs, than saline purgatives. After the Calomel has

displayed its influence upon the gums, I give Elaterium alone, in minute doses, dissolved in alcohol.

In *affections of the lungs*, the employment of Purgatives is in some cases a matter of controversy. This is the case in particular with respect to *Pneumonia*. In this country they are freely used, not merely to empty the bowels, but to deplete and to reduce the action of the heart and arteries. Dr. Pring regards them equal to blood-letting in subverting the inflammatory action. It has been considered as an objection that they are unfavourable to expectoration; but I am of opinion that their contra-stimulant influence on the alimentary canal greatly overbalances that objection. It must, however, be recollected, that a continued alvine discharge is very apt to cause the attendant fever to sink into a typhoid character, when the purgation is procured by saline cathartics; consequently it should be elicited by colocynth or the Senna draughts; or, if any signs of gastric excitement be present, by Castor Oil, or mild Enemata.

In *Pleurisy*, the saline purgatives are admirably suited to the first stage, as they lessen the mass of the circulating fluid, by augmenting the excretive secretion of the intestinal mucous surface.

In *tubercular Phthisis*, in the early stage, when bleeding is indicated, a saline Cathartic co-operates with the lancet, and keeps up the effect it produces. When tubercles appear in the mesentery, producing what might be termed intestinal consumption, the combination of Infusion of Senna and Salts is well adapted both for emptying the bowels and diminishing the circulating fluid, by exciting the intestinal exhalants. In the Mesenteric decline, also, a similar combination, in a moderate quantity, is also serviceable. Some practitioners have carried the purgative system in this instance very far: "even," says Dr. Young, in his learned work on the treatment of Consumptive Diseases, "in obstinate diarrhœa occurring as a symptom of hectic fever, it is often of use to give a single cathartic, as well for the purpose of carrying off any offending substance, as in order to diminish the irritability of the secreting membrane, by a temporary exhaustion of its powers. We find," continues he," "many timid practitioners very studious to avoid the use of laxative medicine, for fear of promoting diarrhœa: but I have given them again and again with a contrary effect; and Dr. Donald Monro has testified their frequent utility in similar cases." I confess that I am one of these timid practitioners, and I always dread the consequences of ordering purgatives, except in the earliest stages of Phthisis. In every instance, after tubercles are developed in the lungs, and especially if they have run on to ulceration, I have observed that every symptom is augmented by the use of purgatives. I am nevertheless not

bigoted to any opinion, and cannot at all accord with the remark of Sydenham, that Cathartics promote a tendency to Phthisis, when they are administered after the appearance of hœmoptysis.

In affections of the *urinary organs*, purgatives are frequently useful. Thus, when a calculus is passing from the kidney, and appears to be delayed in the ureter, a brisk purgative of Sulphate of Potassa and Rhubarb will be found to facilitate its progress. After it has dropped into the bladder, Castor Oil, Sulphate of Potassa, and Rhubarb, should be administered at intervals. In this case, it is supposed that the purgative facilitates the passage of small calculi through the urethra: but this I think doubtful.

The proximity of organs often produces not only diseases in both places when one only has been subjected to external existing causes; but a cure is sometimes effected in one organ, by directing our remedies to another. Thus Leucorrhœa may depend upon a loaded state of the rectum, or on the presence of ascarides there; and when that is the case, a soap and turpentine enema, repeated once or twice, will cure both diseases. Young girls, also, are now and then affected with a vaginal discharge resembling Leucorrhœa, from other intestinal irritations, such as gravel: the remedies in this case are gentle purgatives, combined with alkalies. This is a condition of the vagina which may readily be mistaken for gonorrhœa: and on every account it is of importance to form a correct diagnosis. It is said that in this vaginal disease there is no ardor urinæ; and the redness and tumefaction of the labia, nymphæ, &c. is less than in Gonorrhœa: but, in cases where the discharge in leucorrhœa is very acrid, these symptoms are present. Nothing indeed is more difficult than to form a correct diagnosis in such a case.

In *Hæmorrhoids*, whether depending on a dilated state of the veins, or a varicose condition of the hæmorrhoidal veins, or on fungous and polypous growths of that part of the intestinal tube, the accumulation of fæces, by pressing upon these irritable tumors, augments the disease, and induces severe pain; hence, the aid of purgatives is required. In this disease, however, the kind of purgative is of importance: in the majority of cases, that which operates mildly, and promotes the regular excretion of the fæces, namely, castor oil or sulphur, is best adapted for this disease: but, although many of the resinous Cathartics are too violent in their operation—and we are particularly warned, in most works on the treatment of diseases, against the use of aloës—yet the local effect of resinous purgatives on the rectum even proves useful in this affection; as may be observed in the effect of Copaiva, and of Ward's paste, the chief ingredient of which is long pepper, a substance which stimulates the whole of the canal, from the duodenum to the rectum.

It is in diseases of the Cerebro-spinal centres, that purgatives are not clearly indicated.

In apoplexy, Cathartics of the most active description are often requisite. I have hinted the great advantage of employing the oil of Croton *tiglium* in this disease, when deglutition is completely impeded. The merely placing a drop of this oil upon the tongue is often sufficient to excite the evacuation of the intestines. In stating, however, the importance of this class of medicines in apoplexy, it is obvious that little can be expected from the administration of purgatives, except in aid of the lancet. When they prove beneficial, the result must be ascribed as much to their counter-irritant as to their evacuant influence. In many other affections of the head, they are the remedies to be relied upon. In the commencement of hydrocephalus, for example, the disordered state of the stomach and the comatose tendency are often readily removed by active purging. Indeed, in families in which there is a strong predisposition to this disease, I have succeeded in warding it off, until after the age in which its attacks are most frequent and most to be dreaded has passed, by a constant attention to the state of the bowels.

In that form of *Epilepsy* which is termed *stomachica,* the bowels ought to be completely emptied every second day, by means both of a warm aloetic taken by the mouth, aud the use of an enema. Once every week they should be further evacuated, by giving a pill at bed-time, composed of Calomel, Ipecacuanha, Rhubarb and Aloës, in quantities proportioned to the circumstances of the case, and a saline aperient draught in the morning. When tænia is the exciting cause of the Epileptic paroxysm, then oil of turpentine, in large doses, followed by an oleaginous purgative, should be administered. It is chiefly owing to the diversities in the exciting causes, that Epilepsy, even of a symptomatic kind, is rendered so difficult of cure.

In mentioning the advantages of purgatives in Epilepsy, it is requisite to know, that in some individuals, owing to peculiar idiosyncracies, some Cathartics induce the very diseases which they are intended to remove: a dose of rhubarb has produced every symptom of epilepsy; and, in an instance within my own observation, the smallest dose of calomel has caused the most alarming syncope.

Hysteria is undoubtedly a disease intimately associated with a morbid condition of the alimentary canal. The preceding symptoms are pains in different parts of the abdomen, sour eructations, hiccup, flatulence, constipation, vomiting sometimes, and purging; indeed, the usual symptoms of dyspepsia; and after these have continued for some time, a sudden alarm, or any circumstance which can powerfully affect the nervous system, will

bring on all the convulsive efforts that characterize this disease. Dr. Hamilton regards hysteria in this point of view; and considerable improvements in its management have resulted from the purgative practice which he introduced; nevertheless, purgatives alone will not cure hysteria; although its recovery is much promoted by the free employment of purgatives.

It is only in one form of *paralysis*, namely, that which attacks the lower extremities, that purgatives are found useful. The late Dr. Baillie treated such cases chiefly by purgatives; he directed a grain of Calomel, or gr. iss of Blue pill, with one grain of dried Squill, to be taken every night for many weeks, and followed every morning by a purgative. In many instances this mode of management may succeed; but, when the paraplegia is the consequence of disease of the spine, or of Colica pictonum, purgatives can be regarded only as useful auxiliaries to other modes of treatment.

In *convulsions*, purgatives have been always regarded as the most powerful remedies; the administration of a brisk Cathartic, during the paroxysm, in many cases, immediately subduing its violence, especially when the convulsion is connected with visceral irritation. A combination of calomel and jalap is the most active and efficacious form of Cathartic; but, in patients of a delicate frame of body, rhubarb should be substituted for the jalap. "Whilst moderate purging, however," says Dr. Adair Crawford, and the remark is of great importance to the young practitioner, "when moderate purging is decidedly beneficial, the repeated exhibitions of drastic purgatives, which has been a favourite practice in this country of late years, cannot be too strongly condemned. Such a practice tends to induce a state of general exhaustion and nervous irritability, similar to that which results from excessive bleeding. But a moderate course of purging is of the utmost importance as a prophylactic measure in the intervals. The function of secretion appears to be more or less controlled by the nervous system, whatever influence chemical or electrical powers may exert; hence we find that, in all long-continued diseases of the nervous system, the secretions are vitiated, and in their turn become sources of morbid irritation. To correct these, we must have recourse to a long-continued course of mild purgatives, so as merely to obtain free and natural evacuations, but stopping short of the irritating and debilitating effects of active purging. The state of the patient, the appearance of the tongue, the skin, and the excretions, both alvine and urinary, must guide the selection and the doses of purgatives. A combination of blue pill and the compound aloetic pill is, perhaps, the best adapted for such a course.

In *infantile convulsions*, there is often an obstinately constipated state of the bowels, in which purgatives are productive of the most salutary effects, by removing offending matters

from the intestinal canal; but it must be recollected that these will rarely succeed until cerebral pressure has been removed by bloodletting from the jugular vein or the neighbourhood to the head.

In one form of Spasmodic disease, *Tetanus*, more caution is requisite respecting the use of purgatives than even in convulsions. It is highly probable that, in every instance, the exciting cause is a morbid irritation; which, if it cannot be traced to a wound, must be looked for elsewhere; and in no place is it so likely to be found as in the alimentary canal. This view of *idiopathic tetanus* is confirmed by the frequent occurrence of this variety of the disease in countries where the food is of a crude and indigestible kind. In Sir George's Mackenzie's Travels in Iceland, we are informed that, in the group of islands called Westmann-Eyar, situated on the southern coast of Iceland, many of the children are cut off by lock-jaw. These islands are formed of lava; the inhabitants are remarkably indolent; their food consists chiefly of salted fulmars and puffins—very fat, oily sea birds. They have no vegetable food. The disease, therefore appears to arise from the effect of bad food on the constitution of the mother, and the practice of giving to the infant a strong and oily animal diet almost immediately after birth. Whatever may be the nature of the irritation which produces tetanus, it acts on the nerves of the spinal marrow that supply the muscles of respiration. In idiopathic tetanus, if the bowels be cleared out, much of the difficulty attending the cure of the disease is set aside. But although, as far as possible, all offending matters should be removed from the bowels by mild purgatives, yet nothing is productive of more mischief than the drastic purgatives which are too frequently given at the commencement of this spasmodic affection, namely, Scammony, Jalap, Elaterium, and Croton Oil. On the contrary, however, it has been stated, on high authority, that drastic purgatives have failed from not being continued in moderate quantity for a sufficient length of time; and if the view which I have taken of the general distinction between purgatives and drastic Cathartics be correct, it is not difficult to see that, in this diminished degree, as far as concerns quantity or dose, it is, in fact, bringing the drastic Cathartic down to the state of the ordinary purgative. In one species of this spasmodic affection, when the jaw is locked, or, as it is termed, in *trismus*, the bowels are often the seat of the exciting irritation; in which case the application of Croton Oil to the tongue has been productive of the complete resolution of the spasm.

In *Hypochondriasis*, the medicinal treatment is almost confined to a course of mild purgation. All stimulating Cathartics in this case should be avoided; but, at the same time, a course of saline purgatives, from its depressing effects, would be highly

improper. Rhubarb, with Infusion of Senna or of Gentian, combined with some aromatic tincture, may be given daily; or Aloës with alkalies, according to the circumstances of the case. An excellent combination of purgatives and nervous medicines is found in Aloës and Assafœtida: but the remedy of this kind which seems to operate most favourably in Hypochondriacal cases, if required to be long continued, is half a drachm of powdered Rhubarb in half a pint of warm peppermint water, taken every morning.

No medical truth has been more fully established than the statement, that purgatives form our sheet-anchor in cases of *Insanity*. A spontaneous cure of the disease has even resulted from a supervening diarrhœa; and instances, as well authenticated, are recorded, where the accumulation of fæcal matter in the lower bowels has been the chief exciting cause of the malady. But, although thus important, purgatives, as M. Esquirol has justly remarked, ought not to be indiscriminately employed in all cases of Insanity; and they are undoubtedly injurious when the mucous membrane is in a state of inflammation or irritation: but unless signs of the actual existence of disease there display themselves, the use of purgatives is one of the most important of the generally available means of treating Insanity. The neutral salts, senna, rhubarb, and Castor oil, are the purgative agents chiefly indicated: but, if the patient have obstinately resisted the action of the bowels, then recourse must be had either to Croton oil, or to the administration of an Emetic, as I have already stated. In many cases, when the patient can be persuaded to take medicine freely, I have witnessed much benefit result from a combination of Calomel, Tartar Emetic, or James's powder and Jalap. Some nausea accompanies the operation of the bolus; and this aids greatly its purgative power, producing most copious evacuations. The relief thus obtained, however, seldom lasts more than twenty-four hours: and after that time the circulation again quickens, and the delirium recommences: but, after a short time passed in this mode of acting on the bowels, the delirium changes in character, and evinces a disposition more to gaiety than to sadness. A greater degree of costiveness, however, supervenes, with acute pains darting through the head, and sometimes fixed either at the occiput, or over the forehead, whilst the most distressing watchfulness attends this condition of the brain. This reaction must be overcome by a combination of purgatives and emetics. The perseverance in the use of the former depends solely on the aspect of the discharges. If they are dark, broken-down matter, accompanied with scybala, there can be no hesitation in prosecuting purgation. If, on the contrary, they are moderately consistent, with recent bile in them; if there be a remission of symptoms, if the hypochondriac region

be free from tension and pain to the touch, and if the general system seem weakened, then it is time to stop purging.

Where Mania accompanies the puerperal state, purgatives are not less valuable remedies. In general, the tongue is furred, the breath fœtid, the skin discoloured, and the bowels are irregular; symptoms clearly indicating the necessity for purgation. A few brisk purgative doses—calomel, for instance, followed by castor oil, or rhubarb and magnesia—should be administered early, as a prelude to emetics and more active remedies.

The only disease of the serous and cellular tissues which I think it necessary to notice as being benefited by purgatives, is *Dropsy*. The principal cathartics in Dropsy are undoubtedly croton oil and elaterium. One drop or two drops of the former often produce within half an hour profuse purging; but some individuals require even four or five drops to produce this effect. Elaterium operates in still smaller doses; and should not be given at first in doses exceeding $\frac{1}{8}$ of a grain, if the preparation be good: this may be repeated every six or eight hours until free evacuations be procured. Its beneficial influence is greatly aided by its combination with Calomel: and it is not to be overlooked that the purgative influence of the Elaterium does not prevent the Calomel from getting into the habit, and exerting its specific power on the capillary system. In no instance, however, will any course of purgative medicine prove useful in Dropsy, until the general tension of the habit be reduced by bleeding, or by a course of alteratives. In this respect, the same rule holds good with respect to purgatives as with diuretics.

The whole class of Cathartics has been employed for the expulsion of worms, or, as the term is, as *anthelmintics:* but they are only useful for removing the worms which are present in the bowels, not for preventing their generation. The continued use of Cathartics is more likely to foster than to destroy these parasites, by weakening the intestinal canal, and favouring the formation of the mucaginous secretion, which is their nidus.

A regular evacuation of the bowels is almost an absolute essential for the preservation of health; yet it is astonishing how individuals have continued to live and enjoy health, although they have passed weeks, months, and even years, without an alvine discharge. In Heberden's Commentaries, mention is made of a person who had a motion once a month only; several cases of a similar kind are recorded by Haller; but the most remarkable is one mentioned by Ponteau. It was a case of abstinence in a young lady, who had no stool for upwards of eight years: yet, during the last year she ate abundantly of fruit, and drank broth, yolks of eggs, coffee, milk, and tea. I have heard of one instance in which no food was swallowed for six months, the person being nourished by the inhalation of the vapour of fat; and, during this

time, no evacuation of the bowels had taken place. But such relations are not free from suspicion. In some instances we find as remarkable an opposite state of bowels. Heberden mentions a person who had twelve motions daily for thirty years, and then seven every day for seven years. "Neque," adds the Doctor, "vir hic interia macuerat, quin potius aliquanto habitior factus erat*." But these are rare cases. In general, however, when the bowels are not daily relieved, the person is troubled with head-ache, vertigo, weight at the epigastrium, nausea, fœtid breath, and other symptoms indicating derangement of the digestive organs; and emaciation often follows. Small doses of Rochelle salts, in combination with Carbonate of Soda, taken in a state of effervescence with lemon-juice every morning, for some time, form the best means of obviating this condition of bowels. If the patients be beyond the middle age, an admirable purgative for daily use, is a combination of Ipecacuanha, Aloës, and Henbane.

In *Colic*, Cathartics combined with opiates are indicated. In violent cases of *Ileus*, all the ordinary Cathartics fail: instead of which, enemas of Turpentine and infusion of Tobacco have been found useful: administering at the same time Croton oil, combined with Henbane, by the mouth: or, if these fail, the desired effect has sometimes been produced by taking the patient out of bed, and suddenly dashing cold water upon his extremities.

In *intusception*, or the strangulation of the gut, from one portion slipping within another, I have seen immediate relief obtained by throwing in water, per anum, by means of the stomach-pump. De Haen first suggested and practised this plan; and the instrument which he used may be regarded as the original of the stomach-pump. These enemas should, however, be employed before inflammation comes on; for when this occurs, and coagulable lymph is effused, no human means are effectual for the removal of the obstruction; gangrene supervenes, and death ensues.

In all diseases, Cathartics form most useful auxiliaries to other remedies; often modifying their action, and, as frequently, aiding, in the highest degree, their therapeutical powers.

It only remains to add, that as the bile is the natural stimulus for the peristaltic movements of the intestines; and, when its flow is arrested, costiveness supervenes; it is of great importance, in every case of habitual constipation, to prescribe minute doses of blue pill with Aloës; the former to stimulate the torpid action of the liver and the hepatic ducts, whilst the general action of the intestines is solicited by the influence of the Aloëtic on the rectum.

* Comment. de Morb. Hist. cap. v.

SECTION XVI.

DIURETICS.—MEDICAMENTA DIURETICA*.

Diuretics are usually defined, "medicines which augment the urinary discharge." This definition is correct in the general terms in which it states the effect of *Diuretics* on the body; but it neither conveys any idea of the manner in which they operate, nor describes, nor points out any organ upon which their influence is exerted to produce their effects. It might thus be considered defective, as being too general; but it is the only one that can be admitted: for the excretion of urine, under the influence of Diuretics, does not always arise from a direct application of the diuretic substances to the kidneys; but from circumstances connected with the state of the stomach and other organs, under which the kidneys act only a secondary part.

There is no difficulty, however, in proving the accuracy of this definition. Thus it is, daily, illustrated by the fact, that both Excitants and Emollients operate as Diuretics, according to the condition of the kidneys and the general habit at the time of administering them. Some Excitants, for example, when taken into the stomach, are specially determined to the kidneys; and, being carried there either wholly or in part, rouse the vital energy of the organs, and consequently augment their secreting power; whilst, at the same time, the greater supply of blood affording the pabulum to be acted upon, the result is an increased quantity of that peculiar fluid which these organs are destined to separate from the blood. Both the cause and the effect are equally demonstrable; for the substance operating as a Diuretic can generally be detected in the urine; and, when it is an odorous substance, it becomes obvious to our senses. But, if equal doses of Excitants be given to healthy individuals, the same effects do not follow, much depending on the condition of the secreting organ. On the other hand, whatever stimulates the kidneys beyond a certain point, instead of increasing, diminishes greatly their secreting powers: we have frequent proofs of this fact, in fever, and other diseased states of the habit. Even the salts contained in the urine itself increases the action of the kidneys. In this case, emollient and demulcent fluids, by sheathing the acrimony of the circulating mass, favour greatly the re-establishment of the natural function of the kidney, and operate as diuretics. In the first case, therefore, Diuresis is the consequence of an excitement of the kidneys, and the Diuretic is an active agent: in the second, the effect is the consequence

* From διαι and οὐρεω.

of diminishing excitement in the kidneys, and the Diuretic is a *passive* agent. Diuresis, also, arises from circumstances connected with certain conditions of the stomach, in which the kidneys act only a secondary part.

Diuretics are supposed to operate in four distinct ways. 1. By the substance passing into the circulation, and reaching the kidneys without undergoing any decomposition in *transitu*, acting directly as stimulants to the urinary organs. 2. By suffering decomposition in *transitu*, and aiding, by one or more of their constituents, the secretion of the urine. 3. By acting primarily on the stomach and primæ viæ, communicating their action by sympathy to the kidneys. 4. By stimulating the torpid capillaries to more healthy action, thereby preventing the undue effusion of fluids into the serous cavities, and enabling the absorbents to convey back those already effused into the circulation, to be discharged by the kidneys. To understand these methods of action, it is requisite that we should have a correct knowledge of the structure and functions of the kidney.

In the longitudinally divided kidney, the organ displays two parts: one exterior, or, as it is termed, *Cortical;* the other interior, or *Medullary*. The secreting part of the organ is situated in the cortical portion, and consists of small vessels arising from the sides of the capillary arteries, and running into vascular glomerules, hanging from them like berries from stalks: from these arterial glomerules spring minute, colourless, secreting vessels, and also the radicles of veins for conveying back into the venous trunks the blood, after it has been deprived of the secreted fluid. The secreting ducts terminate in the excreting tubes; which, pursuing a straight course through the medullary substance, coalesce into a few trunks, the open mouths of which perforate the papillæ in the pelvis of the organ. Each of these papillæ corresponds to an original lobe of the kidney, and conveys the urine secreted in that lobe into its infundibulum: the union of the infundibula forms one large membranous cavity or pelvis, which terminates in the ureter.

1. Now, the blood sent to the kidney passes through the glomerule in innumerable streams, and supplies the pabulum from which the urine is secreted. The blood, therefore, is the natural stimulus of the kidneys; and whatever it can convey to these organs must more or less affect this natural function, so as to increase or diminish the discharge of urine. Hence the inquiry, in what manner is this effected?

According to Berzelius, urine consists of about 933 parts of water, 30·10 of *urea* (a peculiar substance, which is a compound of 2 eq. of nitrogen = 28·3, + 2 of oxygen = 16, + 2 of carbon = 12·24, + 4 of hydrogen = 4, equiv. = 60·54), 17·14 of *lactic acid and lactate of Ammonia*, 1·00 *lithic acid*, 0·32 *mucus of the bladder*, 3·7 *sulphate of potassa*, 3·16 *sulphate of soda*, 2·94 *phos-*

phate of soda, 1·65 *biphosphate of Ammonia,* 4·45 *chloride of sodium,* 1·50 *hydrochlorate of Ammonia,* 1·00 *phosphate of Lime and Magnesia,* and 0·03 *silica,* = 1000·00*. And hence the kidneys have been regarded as the great outlet for nitrogen from the system. The *urea,* the largest component, if we except the water, is separated from urine by evaporating it, and acting upon it by alcohol, which dissolves the urea; and then evaporating till it crystallizes; or, it may be detected by evaporating urine to the consistence of a syrup, and pouring into it concentrated nitric acid, which, combining with the urea, forms shining crystals, closely resembling that of boracic acid. There are two free acids supposed to be present in healthy urine: one, which is the cause of fresh urine reddening litmus, the *lactic;* the other, which appears sometimes in red crystals, the *lithic:* but, instead of the reddening being caused by free acid, Dr. Prout regards it as the effect of the superurate of ammonia. It is astonishing how small a quantity of animal mucus and albumen can be detected in healthy urine. Infusion of gall-nuts precipitates albumen: and, in some diseases—in sthenic dropsy, for example—the quantity is so great, that it may be detected by merely heating the urine, which coagulates both by heat and acids when it contains much albumen: in some instances it has spontaneously coagulated within the bladder. But, besides these principal components, we have seen that urine contains sulphates of soda and potassa; phosphates of soda and ammonia; hydrochlorates of soda and ammonia; lactate of ammonia; with a trace of fluate of lime, and siliceous earth. Knowing that these are the components of urine, it is not difficult to ascertain what substances have passed through the kidneys, and whether these have undergone decomposition. Thus, if free potassa or soda, or nitrate of potassa, be taken into the stomach, so as not to act upon the bowels, and be afterwards found in the urine, we are authorized in concluding that they have passed through the blood, and were directly applied to the kidneys, from which they are excreted in solution with the watery part of the urine. The excretion, however, of these salts does not take place until they have stimulated the viscus to an increase of its natural function, and consequently to the formation of more urine than is secreted in the usual state of the organ. It is a curious fact, that, although these substances can be detected in the urine, they cannot easily be discovered in the blood, which carries them to the kidney. Thus, nitre can be readily detected in urine by the deflagrating of a piece of paper soaked in the urine and dried; which only occurs if nitre be present in the urine; and many other substances, as will presently be seen, also pass unchanged into the urine: and are excreted with it. The facility, indeed, with which some substances taken into the stomach are conveyed into

* Chim. Anim. p. 342.

the kidney, led Sir Everard Home to suppose that they pass through the spleen: but he afterwards abandoned the idea; for, on removing the spleen and tying the thoracic duct, the colouring matter of Rhubarb, injected into the stomach of a dog, could be detected in the urine, while no trace of Rhubarb was discovered in the lacteals*. There is no difficulty in detecting some substances in the urine: if Rhubarb be present, and any of the mineral alkalies be added, a deep orange colour is produced; if Iodine be present, a deep blue colour is evolved when starch is mixed with the cold urine and chlorine gas is poured on the surface of the mixture. In jaundice, the bile passes again into the blood, and is separated from it in the kidneys, and can be detected in the urine by hydrochloric acid causing a green tint. From what has been said, it is evident that some substances are conveyed by the blood to the kidneys; and if these are of a nature to stimulate the viscera, provided the excitement be short of inflammatory action, a greater discharge of urine is the consequence. It is this class of substances which form the first description of Diuretics.

2. The medicinal substances which reach the kidneys and pass into the urine undecomposed, and are excreted with it, must be in solution. The following are enumerated by Woehler. Carbonate, chlorate, nitrate of potassa, ferrocyanate of Potassa, biborate of Soda, chloride of Barium; many colouring matters, as those of camboge, rhubarb, madder, logwood, whortleberries, and mulberries; the odorous principles of juniper, valerian, assafœtida, garlic, castor, saffron, and opium; and the intoxicating principle of Agaric. To which I should add, tannic and gallic acids, the oil of cajuputi, and of cubebs.

Although the chief use of the kidneys is to excrete *Urea* and *lithic* acid, yet, all soluble, superfluous matters, that do not suffer decomposition in the system, are excreted by them in solution in the water of the urine.

* Shehberger ascertained the time which several substances take to pass into the kidneys, by experimenting upon a boy who had inversio vesicæ; and formed the following table of the results† :—

Substances.	Time when first detected in the urine.	Time when it was exuded in greatest quantity.	Time when it ceased to be perceptible.
Madder........in	15 minutes.	1 hour.	9 hours.
Indigo........	15 ,,	$1\frac{1}{4}$,,	$4\frac{1}{2}$,,
Rhubarb........	20 ,,	$1\frac{1}{3}$,,	$6\frac{1}{3}$,,
Gallic Acid........	20 ,,	$2\frac{1}{2}$,,	11 ,,
Logwood........	25 ,,	$1\frac{1}{4}$,,	$6\frac{3}{4}$,,
Uva Ursi........	45 ,,	$1\frac{3}{4}$,,	$7\frac{1}{3}$,,
Cassia pulp........	55 ,,	4 ,,	24 ,,
Ferrocyanide of Potassium........	60 ,,	0 ,,	$3\frac{3}{4}$,,
Inspissated juice of Elder berries........	75 ,,	0 ,,	0 ,,

† Tiedemann's Zeitschrift, 1. Brands, quoted by Müller, Elem. of Phys. ii, 47.

I may here remark, that the excretion of *urea* by the kidneys seems to be absolutely essential to the health of the system. When both kidneys are taken away in a dog, the animal dies before the ninth day: and the serosity of the different secreting organs gives traces of the presenee of urine in it. It must however be recollected, that, in health, when the kidneys are entire, *Urea* is found in the perspiration. There are instanees also of persons who have passed no urine for many years together; and Dr. Riehardson, in a paper published in the Philosophical Transactions of 1713, mentions the case of a lad of seventeen, who had never made any urine, and, nevertheless, suffered no inconvenience. Besides the evidence of several saline matters passing through the circulation, and being excreted by the kidneys unaltered, some vegetable principles, as already stated, follow the same course. Odorous and colouring principles may be detected in the urine an hour or two after these substances have been swallowed; and iodine in a much shorter time. Water also passes off in this way; and, therefore, the excretion of urine is generally in proportion to the quantity of fluid drank.

With regard to the manner in which the kidney is stimulated to increased action when the blood sent to it contains saline and other substances, which, having been taken into the stomach, are found in the urine, it is obvious that their aetion must be within a certain limit; for, were the excitement of the kidney sufficient to induce inflammatory action, the urine, instead of being augmented in quantity, would be scanty and high coloured—a fact of great practieal importance. As the quantity of urine excreted is also generally proportionate to that of the fluid taken into the stomach, the necessity of dilution, to promote the operation of Diuretics, is obvious. None of the substances possessing diuretic properties require the addition of dilution so much as those which pass undecomposed into the blood. Without this, they would scarcely be conveyed to the kidneys; and if they were, the over-excitement which would be induced would check rather than promote the increase of the urinary discharge.

Their action, also, is much modified by the function of the skin. When a diuretic is administered, the surface should be kept cool; for if the cutaneous exhalants be stimulated by heat, the action of the medicine is determined to the surface by that law of the system which regulates the balance between the skin and the kidneys as exeretories; and sweating supervenes, with a diminished discharge of urine: just as, in the healthy state, oceurs in cold weather, when the surfaec is chilled, the quantity of urine is abundant and pale; whilst, in hot weather, when perspiration flows freely, the urine is scanty and high coloured. On this account, the season of the year, clothing, and all circumstances influencing the function of the skin, modify the operation of direct Diuretics.

3. Many vegetable and also some saline bodies suffer digestion to a certain extent, and only one or more of their constituents reach the kidneys: and it is a curious fact, that the salts which undergo decomposition in transitu are those into which the vegetable acids enter as components; namely, potassa and soda with the acetic, tartaric, citric, and malic acids. These acids, in their free state, are extremely prone to decomposition; and it would seem that the power by which this is effected, in the stomach and intestines, is also sufficient to separate them from the alkalies with which they are united. The acid thus separated is decomposed, whilst the alkali is taken into the circulation, conveyed undecomposed to the kidneys, and excites that action which promotes the secretion and excretion of the urine. This remark, however, does not generally apply: for some salts, compounds of vegetable acids with alkalies—bitartrate of potassa, for instance—operate in a manner which cannot be explained upon the supposition that the alkali only is conveyed to the kidneys. In some instances, the decomposition which occurs gives occasion for the formation of new compounds, which pass through the kidneys undecomposed. Sulphur passes off in the state of sulphuric and hydro-sulphuric acids; iodine, in the state of hydriodic acid; and succinic and oxalic acids, in the state of succinates and oxalates. Dr. Paris seems inclined to believe that the *bitter principle* is the active ingredient of the vegetable diuretics which are decomposed by the digestive organs*. I am not prepared to deny the accuracy of this opinion; but, if we may reason from analogy, I should be disposed to ascribe the effect to some alkaline principle, which it is probable all vegetable diuretics contain. That other principles of vegetable bodies are separated during digestion, and determined to the kidneys, is evident from the odour which asparagus and garlic impart to the urine; and, as these substances are in some degree diuretic, it is not improbable that they possess this quality from the principle, whatever it is, which affords the odorous matter. Salts containing vegetable acids, which undergo decomposition in the digestive process, are more diuretic, in proportion as they are more susceptible of decomposition, than those which contain the same acids in proportions only sufficient to neutralize the alkalies with which they are united. Thus the bitartrate of potassa is diuretic, whilst the neutral tartrate has no effect whatever upon the kidneys. Dr. Paris remarks, that "the diuretic operation of any body that acts by being absorbed, is at once suspended if Catharsis follow its administration;" owing to the law of the œconomy, "that the processes of assimilation and absorption are very imperfectly performed or altogether arrested during any alvine excitement." Although this opinion is pretty

* Pharmacologia.

generally admitted, yet, there are exceptions to it: thus, when calomel and elaterium are administered in combination in dropsy, however actively the latter substance operates as a purgative, it does not prevent the introduction of the calomel into the system; and, owing to its general influence on the capillary vessels, the flow of urine it rather augmented than diminished in quantity. Something, however, is due to the natural extent of the dose of the substance employed; seeing that many substances, within certain limits, as regards the doses in which they are administered, operate as diuretics, but, beyond these limits, as cathartics: thus, the bitartrate of potassa in large doses purges; in small, it stimulates powerfully the kidneys: oil of turpentine, in doses of from ten or fifteen minims to a fluid drachm, stimulates the kidneys so powerfully as to cause bloody urine; yet, if a fluid ounce be administered, little effect is perceptible on the urinary organs; and in the same manner, when nitrate of potassa has been taken by mistake for sulphate of magnesia, to the extent of an ounce for a dose, the symptoms do not indicate any action upon the kidneys.

4. The third description of Diuretics, those which operate without passing to, or acting at all on, the kidneys, are substances that augment the nervous energy, give an impulse to the general vigour of the habit, and produce tone. Among these, Woehler mentions the salts of Iron and of Lead, Alcohol, Sulphuric Ether, Camphor, Dippel's Oil, and Musk. In naming the salts of lead, however, it is necessary to state that Orfila found acetate of lead in the urine of a girl who had been poisoned by having swallowed ℥x of it, and was recovered by sulphate of soda. Lassaigne also found salts of lead in the urine of animals poisoned by them: but M. Chevalier, of Brichateau, could not detect it in the urine of a man who suffered from lead poisoning. In a weakened condition of the body, the fluid deposited by the exhalants in the serous cavities and cellular tissue accumulates; and when the cutaneous system shares in the general debility, asthenic anasarca is the consequence. In such conditions of the body, the employment of bitters produces a diuretic effect; for the tone of the body being increased, all its natural functions are augmented, and those of the urinary organs in particular, so that an increased flow of urine follows.

5. The last division of Diuretics is intended to demonstrate the manner in which some substances that produce diuresis, effect that result by their primary action on the capillary system. They are substances that diminish arterial action, whilst they augment that of the capillaries. It is a well-known fact, that if digitalis be given while the habit is labouring under a state of inflammatory excitement, it produces little or no effect on the kidneys; but if this excitement be previously reduced, the influence of the remedy on the capillaries becomes quickly

obvious, by the increased flow of urine. Indeed, experience daily demonstrates the activity of this diuretic in weakened habits, if the debility have not proceeded too far; and, also, how imperfectly it operates when the system is under the influence of febrile excitement. Hence the necessity of watching, attentively, the state of the system during the employment of Diuretics, in order to obtain their full influence; and, if the excitement continue, to intermit the use of the Diuretic, and to have recourse to venæsection and purging before again administering it.

Besides these different modes in which diuresis is induced, it is necessary to advert briefly to the influence of mental affections on the urinary discharge. Whatever suddenly depresses the nervous energy, produces diuresis; hence all the depressing passions have this power. Fear has a considerable influence in this respect: various sounds* and even odours operate in the same manner through the medium of the nerves.

Diuretics, from the increased discharge of urine which they induce, operate as evacuants; but at the same time they also exert a stimulant influence. As *evacuants*, they remove the general plethoric state of the system, and diminish, also, the excitement of the habit without inducing much debility; for, as the abstraction of the fluid, which they chiefly separate from the circulating mass, is slowly effected, the vessels contract, and gradually adapt themselves to the diminished quantity of their contents. As evacuants, also, they are supposed to carry off acrimonious matters from the blood; but the existence of such matters in the blood is doubtful. As *stimulants*, Diuretics act on the general and the capillary system, even when they exert a direct action on the kidneys. As far as their effects depend on their stimulant properties, they are therefore contraindicated in all inflammatory and irritable states of the kidneys; in which, the simple dilution is to be preferred. Water is the best diluent: how far it acts a part in the operation of all Diuretics, is not accurately known; but it has, undoubtedly, a considerable influence in modifying their effects; and, when freely administered, in directly promoting diuresis.

In the employment of Diuretics, the following rules should be strictly attended to, in order to insure their operation.

1. On account of the necessity for keeping the surface cool during the operation of Diuretics, the day time is to be chosen

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* Shakspeare, who allowed nothing to escape his notice, remarks, in the person of Shylock,—

> And others, when the bagpipe sings i' the nose,
> Cannot contain their urine; for affection,
> Masterless passion, sways us to the mood
> Of what it likes or loaths.—*Merchant of Venice.*

for administering them; and, during their action, the patient should, if possible, be kept out of bed.

2. Their influence is increased by exercise and friction on the surface of the body.

3. Care ought to be taken, in selecting the diuretic substances, to ascertain which description of those usually employed is best fitted for the case: and to reduce the arterial action, by bleeding and other means, rather below the natural standard, before administering Diuretics; but never to bleed nor purge during their actual operation; and, when full diuresis is desired, to administer freely diluent drinks.

4. After Diuretics have produced all that can be expected from them, tonics should be prescribed.

TABLE OF DIURETICS.

A. DIRECT DIURETICS.

1.—not undergoing decomposition in transitu.

* *Organic Products.*

a.—Volatile Oil—uncombined, from

Abies *Larix*.	21.	6.	Coniferæ.
* —— *balsamea*.	—	–	————
* —— *Picea*.	—	–	————
Pinus *Sylvestris*.	—	–	————
* —— *Pinaster*.	—	–	————
Juniperus *communis*.	22.	2.	————
Melaleuca *Cajuputi*.	12.	1.	Myrtaceæ.

* * *Inorganic Substances.*

b.—Iodine.

c.—Potassa.

d.—Diluted Mineral Acids.

e.—Salts.

Chloride of Barium.
Iodide of Potassium.
Nitrate of Potassa.
Chlorate of Potassa.
Biborate of Soda.

2.—undergoing decomposition in transitu.

** Organic Products and Substances.*

Animal.

f.—CANTHARIDIN—procured from

	Cantharis *vesicatoria.*	4.	5.	Coleoptera.
*	——— *vittata.*	–	–	———
*	——— *atrata.*	–	–	———
*	——— *marginata.*	–	–	———
*	——— *cinerea.*	–	–	———
*	——— *atomaria.*	–	–	———
*	——— *ruficeps.*	–	–	———
*	Mylabris *variabilis.*	–	–	———
*	Meloe *proscarabæus.*	–	–	———
*	—— *majalis.*	–	–	———

Vegetable.

g.—OLEO-RESINS—contained in

	Copaiferæ variæ.	10.	1.	Amyridaceæ.
	Piperis *Cubebæ* baccæ.	2.	3.	Piperaceæ.
	Juniperus *communis.*	22.	13.	Coniferæ.
	Barosma *crenulata.*	5.	1.	Rutaceæ.
*	——— *serratifolia.*	–	–	———
*	——— *crenata.*	–	–	———

h.—COLCHICIA—contained in

	Colchicum *autumnale.*	6.	3.	Melanthaceæ.

i.—SCILLITINA—contained in

	Scilla *maritima.*	6.	1.	Liliaceæ.
*	—— *Pancration.*	–	–	———
	Allium *sativum.*	–	–	———
	——— *Cepa.*	–	–	———

k.—ULMIN—contained in

	Ulmus *campestris.*	10.	1.	Ulmaceæ.

l.—UNDETERMINED PRINCIPLES—in

Roots.—	Cochlearia *Armoraceæ.*	15.	1.	Cruciferæ.
	Smilax *Sarsaparilla.*	22.	6.	Smilaceæ.
	* ——— *officinalis.*	—	–	———
	* Cocculus *Febraurca.*	22.	10.	Menispermaceæ.
	* Anthyllis *Hermaniæ.*	10.	1.	Leguminosæ.
	* Petroselinum *sativum.*	5.	2.	Umbelliferæ.
	* Liatris *squarrosa.*	19.	1.	Asteraceæ.
	* Lappa *minor.*	—	–	Cynaraceæ.
Rhizomes.	Polygala *Senega.*	17.	3.	Polygalaceæ.
Herb.	* Polygonum *Hydropiper.*	8.	3.	Polyganaceæ.
	* Anagallis *arvensis.*	5.	1.	Primulaceæ.
Twigs.	Spartium *scoparium.*	10.	1.	Leguminosæ.
Bark.	* Capparis *spinosa*			Capparidaceæ.
Leaves.	Chimaphila *Corymbosa.*	10.	1.	Pyrolaceæ.
Fruit.	Daucus *carota.*	5.	2.	Umbelliferæ.

** * Inorganic Substances.*

m.—Acids.

Carbonic Acid.
Tartaric Acid.
Citric Acid.

n.—Salts.

Carbonate of Potassa.
Bicarbonate of Potassa.
Acetate of Potassa.
Citrate of Potassa.
Bitartrate of Potassa.
Carbonate of Soda.
Bicarbonate of Soda.
* Nitrate of Ammonia.

B. INDIRECT DIURETICS.

1.—operating through the blood.

** Organic Products.*

o.—Nicotina, in				
Leaves.	Nicotiana *Tabacum.*	5.	1.	Solanaceæ.
p.—Digitalia, in				
Leaves.	Digitalis *purpurea.*	15.	1.	Scrophularinaceæ.
q.—Unknown Principle.				
Leaves.	* Taxus *baccata.*	23.	13.	Taxaceæ.
Bark.	* Prinos *verticillatus.*			Aquifoliaceæ.

** * Inorganic Substances.*

r.—Tincture of Sesquichloride of Iron.
s.—Ardent Spirits.
t.—Spirit of Nitric Ether.

2.—augmenting the tone of the habit.

u.—Vegetable Bitters.

3.—acting primarily on the capillaries.

v.—Mercurials.

A. INDIRECT DIURETICS.

ORGANIC PRODUCTS WHICH DO NOT UNDERGO DECOMPOSITION IN TRANSITU.

a. Volatile Oils.

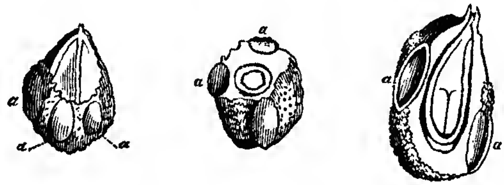
1. Oil of Turpentine. *Terebinthinæ Oleum.* L. E. D. —From whichever of the species of Pinus, or of Abies, Oil of Turpentine is procured, or in whatever manner it is introduced into the habit, it rapidly displays its presence in the urine

by the odour of violets which it communicates to that secretion. It stimulates the kidneys locally: but its effects are greatly influenced by the extent of the dose;—in small doses, it passes to the kidneys; in larger, it operates upon the intestines and the nervous system. Owing to idiosyncracy, in some individuals, it causes a cutaneous eruption, resembling eczema mercuriale: at other times, it induces strangury, with bloody urine; but most commonly it operates as a simple excitant to the kidneys, augmenting their secreting power, and consequently increasing the flow of urine. When an eczematous eruption occurs, or when bloody urine or suppression happen during the use of Oil of Turpentine, the remedy should be instantly discontinued. During its employment, also, wine and spirits, and the ordinary quantity of food, should be diminished. Dose, f℥ss to f℥i.

2. CAJUPUTI OIL, which has been already described (p. 89), possesses the same diuretic properties as oil of turpentine, and sometimes produces the same eczematous rash. Dose, m. iv to m. v, in the form of an oleo-saccharum.

3. OIL OF JUNIPER, *Oleum Juniperi*, L. E. D., has also a close affinity to the oil of turpentine. It is procured from the fruit of the Juniperus *communis**, the enclosed nut of which is surrounded at its base with three or four glandular vesicles, that secrete the oil. At *a, a, a,* fig. 1, these are displayed entire and largely magnified; *a, a,* fig. 2, shew them in a transverse section of the nut; *a, a,* fig. 3, in a longitudinal section. The plant,

1 2 3



which belongs to the natural order Coniferæ, is found in most parts of Europe, growing on heaths and hills. It is a thick, evergreen shrub. The leaves are in threes, linear, mucronate, and of a deep green colour. The flowers are on separate plants, unisexual: the male axillary, with roundish, acute stipulate scales, enclosing several anthers: the female with a small three-partite involucre. The fruit is a cone, the scales of which are so much swelled and succulent as to give it the appearance of a berry.

The greater part of the Juniper berries, as they are termed, is imported into this country from Italy, and these are preferred to those from Germany and Holland, on account of their superior

* Woodville's Med. Bot. 3rd edition, p. 13, pl. 6. London Dispensatory, art. Juniperus. Richard, Hist. Nat. Med. t. i, p. 469. Nees von Essen. 86. Lindley, 556.

succulence and plumpness. According to Tromsdorff, the fruit of the Juniper contains 1·0 of *volatile oil*, 4·0 *wax*, 10 *resin*, 33·8 *saccharine matter*, with *acetate* and *malate of lime*, 7·0 *gum* with salts of *potassa* and *lime*, 35 *lignin*, 12·9 *water*, = 100·00. Both water and alcohol bring over, in distillation, the volatile Oil of Juniper; but not unless the fruit is well bruised, so as to open the vesicles that contain the volatile oil. When properly treated, the oil obtained by distillation is greenish, has the odour of turpentine, and a hot, pungent taste. The composition is $C.^{10} H^{8}$. equiv. = 69·20.

Juniper has long been employed to excite the action of the kidneys in hydropic diseases. The oil is carried into the blood and conveyed undecomposed to the kidneys, where it is excreted with the increased flow of urine. As the whole of the plant yields this volatile oil, the extremities of the shoots, or Juniper tops, as they are termed, are as diuretic as the fruit; but the mucous and saccharine matter not being present, the decoction of the tops is more nauseous, and, therefore, less frequently employed than that of the fruit. The fruit, which is about the size of a large pea, of a purplish-black colour, with a bloom upon it, is sometimes given in substance, in doses of ℈i to ℈ii, triturated with sugar or with bitartrate of potassa; but it is more diuretic in the form of decoction. A spirit flavoured with the oil, by being rectified with the fruit, *Hollands*, is frequently and advantageously added to the decoction. What is termed Gin, in this country, was originally an imitation of Hollands, and was also rectified from Juniper; but the gin now used is made from Scotch and Irish whiskey rectified on turpentine. If the spirit were good, the English gin is a better Diuretic than Hollands, inasmuch as the Oil of Turpentine is a superior Diuretic to the Oil of Juniper. The dose of the oil is m. iv to m. vi; it may be given combined with sugar, as an oleo-saccharum; and, when this is added to any bland fluid—for instance, emulsion of almonds—it is the best mode of administering this Diuretic.

All of these oils are employed to excite the action of the kidneys; but, in effecting this, they probably also influence generally the capillary system. The Oil of Turpentine is the most useful of the three.

Compound Spirit of Juniper, *Spiritis Juniperi compositus*, L. E. D. is made by mixing or marcerating ℥xv (lb. i, E. D.) of Juniper fruit; carraways bruised, fennel bruised, of each f℥ii (℥iss, E. D.) in cong. j (Ovii, E.) of proof spirit and Oii of water, then distilling off a gallon (Ovii, E.).

* * INORGANIC DIURETICS WHICH DO NOT UNDERGO DECOMPOSITION IN TRANSITU.

b. Iodine, *Iodineum.* L. E. D.—The nature of this elementary substance has been already explained (p. 143). I have only to add here, that it is sometimes adulterated with plumbago and other things. The quantity of the plumbago can be readily ascertained by volatilizing a given portion of the suspected specimen and weighing the residue.

As a Diuretic, Iodine is given in alcoholic solution, or tincture. When administered internally, in doses of from m. v to m. xv, in a glass of water, twice or thrice a day, this tincture stimulates very powerfully the whole of the glandular system, and, in a special manner, the kidneys. This renders it a most useful remedy in ascites, connected with diseased states of the liver and the mesenteric glands. Dr. Baron, of Gloucester, succeeded in curing that disease by its means; and I believe a case has also proved successful in the hands of Dr. James Johnson. I have taken advantage of this decided effect upon the capillary system to render Iodine beneficial in the treatment of organic disease. In one case of ovarian dropsy, the Tincture was administered immediately after tapping, in conjunction with mercury, three times a day, in doses gradually extended to sixty minims: under its use the swelling disappeared, and health was restored. In this instance, it is probable that the great advantage arose from the rapidity with which the Iodine was thrown into the habit after the tapping, and whilst the flaccid sac remained as a kind of extraneous body in the abdomen. It has not, however, proved equally beneficial in similar cases in my hands: but in some other cases, which have been treated in the same manner, although a cure has not been effected, yet the period for tapping has been greatly protracted: for instance, in one case from ten weeks to six months. Like foxglove, it does not act beneficially when the abdomen is tense; but, after tapping and reducing the excitement by blood-letting, it rapidly displays its influence on the kidneys. It is the only substance which seems to stimulate decidedly the absorbents; and their influence, when thus urged, extends even to healthy glands: it is well known that both the mammæ and the testicles, free from disease, have, in several instances, nearly disappeared during its administration. The Tincture has also succeeded in reducing enlargements of the liver when all other means had failed; and, at the same time, cured the ascites connected with the deranged condition of the organ. Its influence in bronchocele and other enlarged glands, whether of a scrofulous or an incipient schirrhous nature, has been well authenticated. Out of 109 cases of scrofula treated by M. Lugol at the Hospital St. Louis, in seventeen months, 26 were completely cured, 30 greatly benefited, 4 not improved,

and 39 under cure when the report was made. Iodine only was internally administered, and externally applied.

Some inconveniences arise from its employment in irritable habits. It causes a febrile state, often accompanied with nausea, vertigo, and headache, loss of appetite, extreme muscular debility, fainting, a frequent feeble pulse, clammy sweats; and, occasionally, with dysenteric symptoms. In some respects the symptoms resemble those of paralysis agitans, shaking palsy; sometimes it excites profuse perspirations; and griping pains of the stomach and bowels. When these occur, the use of the medicine must be suspended.

Iodine exerts a decided influence in softening and removing bronchoceles and scrofulous tumours; but when febrile symptoms, cough, and nervous irritability occur, such as I have already noticed as requiring the medicine to be discontinued, it is then productive of much danger. In its administration, therefore, the attention of the physician to the general state of the patient should be close and unremitting.

The dose of the Tincture of Iodine is from m. x, gradually carried to m. xl.

Iodine is now generally prescribed in combination with Iodide of Potassium, as in this form it is more manageable and less likely to cause the poisonous symptoms above mentioned than when given alone. The following preparations are in common use:—

Compound Tincture of Iodine, *Iodinei Mistura composita.* L.—Take ℥i of Iodine, ℥ii of Iodide of Potassium, macerate in Oii of rectified spirit till the whole is dissolved, and filter. The dose is m. v to m. xv.

Compound Solution of Iodide of Potassium. *Liquor Iodidi Potassii compositus.* L.—Dissolve gr. v of Iodine, and gr. x of Iodide of Potassium in Oi of distilled water. Dose, m. xx to f℈i.

Compound Solution of Iodine. *Iodinei Liquor compositus.* E.—Dissolve ℈i of Iodine and ℥i of Iodide of Potassium in f℥xvi of distilled water. Dose, f℈ii to f℈iv.

c. Solution of Potassa. *Liquor Potassæ.* L. *Aquæ Potassæ.* E. *Potassæ Causticæ Aqua.* D.—The only oxide which has a diuretic influence is that of Potassium, in the form of *Potassa.* This oxide is formed by exposure to air, and even when Potassium is thrown into water, owing to the decomposition of that fluid by the metal. For medicinal purposes, however, Potassa is not produced by the immediate oxidizement of the metal: but by the decomposition of a pure carbonate, by means of quick-lime, the lime attracting the carbonic acid, and leaving the potassa in a free state. When lime is employed to produce this effect, it must be in a state of admixture in water, and the alkali in solution; so that, in order to procure the Po

tassa in the solid form, evaporation must be resorted to; and, when this is properly performed, the salt is obtained in a crystallized state. To obtain a pure salt, the carbonate should be prepared by decomposing bitartrate of Potassa in a heat sufficient to carbonize the vegetable acid. Pure Potassa is a brittle substance, of a white colour, with a peculiar odour, and an extremely acrid taste. In this state, it is pure enough for medicinal purposes: but to free it from every other salt, it must be dissolved in alcohol, which takes up the pure Potassa only, and leaves the other salts. It is still combined with a small proportion of water; and is, in truth, a hydrated protoxide of Potassium. According to Berzelius, pure Potassa consists of 20 parts of oxygen + 100 of Potassium; or of 1 eq. of Potassium = 39·15, + 1 of Oxgen = 8, equiv. = 47·15; but Potassa, as we employ it, is a *hydrate;* hence, by the addition of 1 eq. of water = 9 (KO + Aq.), its equiv. is = 56·15. When Potassium unites with a larger proportion of oxygen, it acquires a yellow colour; and it is curious that, when this peroxide is put into water, it effervesces, gives out its oxygen, and is converted into Potassa.

Potassa is deliquescent, attracting rapidly the humidity of the atmosphere, and is wholly soluble in half its weight in water. It fuses at a temperature of 360°, and at a red heat is volatilized: it displays all the properties of an alkali, changes tumeric paper and infusion of rhubarb to brown; restores the infusion of litmus reddened by an acid; greens the vegetable reds; and, in combination with acids, forms neutral salts. When exposed to the atmosphere, besides deliquescing, it attracts carbonic acid, and is converted into the carbonate. It is distinguished from lime and baryta by not forming precipitates with carbonic, oxalic, and sulphuric acids; and from soda, by forming a crystalline precipitate with tartaric acid. The last test is the simplest and the best; but it requires some attention to avoid fallacy. Thus, the precipitate is redissolved if the quantity of the alkali be considerable: but if the precipitate be redissolved by an alkali, the addition of a small quantity of a strong acid will reproduce it. The precipitate is insoluble in an excess of either tartaric or acetic acid.

Such are the chemical properties of Potassa. As it acts as a powerful escharotic when applied to the body, it cannot be administered internally in a solid form;—it must be largely diluted with water, or with some bland, aqueous fluid. In the form of Liquor Potassæ, it may be given in very large doses, if the dose be gradually augmented and sufficiently diluted. This solution, when properly prepared, is limpid, colourless, and void of any odour: it is too acrid and caustic to be tasted alone; and, when rubbed between the fingers, it feels soapy, owing to a solution of the cuticle. Its specific gravity should be 1·056. It ought

not to effervesce with acids, nor to render lime-water turbid; but it is seldom prepared for medicinal purposes perfectly free from carbonic acid, nor is this perfection requisite. In its ordinary state, when given in doses of from ten minims to f℥ss, in a large cupful of water, or of milk, or almond emulsion, or even beer if it be not sour, it passes unaltered to the kidney, and acts as a Diuretic. When taken into the stomach, however, its primary effect is upon that viscus. If any acid be present, it neutralizes it; and when the dose is sufficiently large to allow the alkali to predominate, it then acts as a sedative upon the stomach, allaying its morbid irritability, and enabling it to secrete the gastric juice more slowly, and consequently in a more healthy state. Its secondary action is upon the kidney, to which it is carried undecomposed; and its passage through it can be detected by testing the urine with infusion of rhubarb or of turmeric. As a Diuretic, Potassa is not extensively employed, owing to a fallacious opinion that it is injurious, if given in doses sufficient to produce its full effect. I have given it to the extent of upwards of 100 drops, three times a day, in Psoriasis, without any bad effect; but, on the contrary, with the greatest advantage. It must not, however, be given in large doses at first; but the dose should be gradually increased until the full quantity which the stomach can bear be administered. As soon as it displays its diuretic effects, the influence of the remedy over the disease becomes obvious: its use must still be continued, and the dose as gradually diminished as it was increased, for some time after the disease has disappeared. It is salutary in several cutaneous diseases; but as a Diuretic in dropsies, it is not much to be depended upon. Its properties as a solvent of urinary calculi shall be noticed in another part of this volume.

d. Diluted Mineral Acids.—Water, acidulated with the mineral acids, is a valuable Diuretic: but, although I have placed water in this state of combination as a Diuretic, which enters the circulation and directly stimulates the kidneys, by the aid of the acid which it contains, yet it is doubtful whether the mineral acids, undecomposed, pass to the kidneys. The acids aid the diuretic properties of the water, by their tonic influence promoting the action of the capillaries; and if we regard water as the basis of every fluid, there is no difficulty in conceiving the extent of its influence in promoting diuresis. The erroneous idea that drinking large quantities of watery fluids is likely to induce dropsy, is now discarded, since the pathology of that disease has been understood. Every one knows that when much fluid is taken into the stomach, many of the secretions are augmented, and, in a special manner, that of the kidneys. In dropsies, if we observe attentively the operation of Nature to effect a cure, we shall seldom fail to remark, that, inasmuch as thirst is one of the symptoms of dropsy, the free use of fluids is

indicated as the curative means in these affections. If the habit be not well supplied with fluid, the secreting vessels of the kidneys are apt to suffer a collapse, and the effused fluid in the cavities is augmented. The beneficial effects of dilution in dropsy was first pointed out by Sir George Baker; and, after him, Sir Francis Milman collected several cases demonstrating the accuracy of the opinions advanced by Sir George, and published them in his Treatise on Dropsy. Whatever may be the character of a Diuretic, it is doubtful whether it will act on the kidneys without the aid of a large quantity of water or watery fluid taken as drink: and this is especially the case with the saline Diuretics. In hydropic affections, it is of some importance to ascertain how diluents are likely to prove serviceable. If we find that the excretion of urine exceeds the quantity of the liquid ingesta, then we may presume that the fluid taken into the stomach is advantageous: but if the opposite effect takes place, and particularly if the dropsical swelling increases under the use of ample dilution, the quantity must be diminished, and other means taken to excite the urinary discharge. If the individual be of a languid habit, and if the inflammatory action connected with the dropsical effusion be subdued, then there can be no doubt of the advantageous combinations of the mineral acids with the water. Experience has fully demonstrated the efficacy of this combination; and, therefore, the rationale of their operation, however desirable it may be to know it, is a matter of secondary consequence.

e. SALTS.

1. Iodide of Potassium. *Potassii Iodidum*, L. E. *Potassæ Hydriodas*, D.—The formula for preparing this salt is different in each of the Pharmacopœias. The simplest method is that adopted by the London and the Edinburgh Colleges; namely, to form an Iodide of Iron in solution, and then to add Potassa or its carbonate to that solution: a carbonate of the protoxide of iron is precipitated, and an Iodide of Potassium is held in solution, and is procured in crystals by the evaporation of the solution. The Dublin College orders *one part* of Iodine to be triturated with *sixteen parts* of water, and having put the mixture into a glass vessel, pass through it sulphuretted Hydrogen gas, extricated from Sulphuret of Iron acted upon by Sulphuric Acid largely diluted with water, until the Iodine disappears. The solution is then to be filtered, and concentrated by boiling to one-eighth, and again filtered. A solution of Carbonate of Potassa is to be added to the concentrated liquor gradually to saturation, and the whole then evaporated to dryness. The residual salt is lastly to be dissolved in six parts of Rectified Spirit, with the aid of heat; the solution decanted and evaporated to dryness. In this process a hydracid is first formed, and then

decomposed on the addition of the alkali, the oxygen of which uniting with the hydrogen of the acid, forms water, whilst the free Iodine and Potassium combine to form the Iodide. This process forms a pure salt; but it is too operose; and the other process forms a salt sufficiently pure for medicinal purposes.

Iodide of Potassium is in irregular, colourless, opaque cubes, of a pearl lustre, and impressing a sharp, saline taste. It is permanent in dry air, but deliquescent in moist air. It is soluble in two-thirds of its weight of water at 60°, and in its own weight of that fluid at 212°. Boiling rectified spirit dissolves half its weight of the salt, and retains twenty-three per cent. of it when the solution is cooled down to 50°. The aqueous solution is decomposed by the mineral acids and chlorine and free iodine are evolved. It consists of 1 eq. of iodine = 126·3, + 1 potassium = 39·15, equiv. = 165·45 (K. I.). Iodide of Potassium aids the solution of Iodine in water, and on this account it is given in combination with Iodine in aqueous fluids. M. Lugol's formula is Iodine gr. i¼, Iodide of Potassium, gr. iiss, and distilled water f℥viii. One-fourth part of this solution is to be administered, in divided doses, in the course of the day. M. Lugol forms a bath also of iodine by similar means—three parts of Iodine and six of Iodide of Potassium are dissolved in 3000 parts of water. M. Lugol has employed this bath successfully in scrofula.

The Iodide of Potassium is often adulterated with carbonate of potassa, the fraud may be detected by adding lime-water, or nitrate of baryta; a white precipite, carbonate of baryta, is produced, soluble in hydrochloric acid, if the carbonate be present. If we suspect chloride of sodium, add a solution of nitrate of silver; and, to the yellow precipitate produced, add an excess of ammonia, and stir the mixture: after some time, filter, and add a little nitric acid; if a chlorate is present, a white precipate will fall. The rationale is this—the nitrate of silver is precipitated as an iodide of silver, which is insoluble in ammonia; but the chloride is soluble in ammonia: the addition of the acid, taking away part of the ammonia, allows a chloride of silver to be precipitated.

The Iodide of potassium is incompatible in prescriptions with the salts of copper, of lead, of mercury, and nitrate of silver. It operates on the kidneys, passing undecomposed to these organs, and can readily be detected in the blood. Iodide of Potassium operates only as a moderate diuretic; but it passes through the kidneys undecomposed, and can be readily detected by adding starch to the cold urine, and pouring upon the mixture gaseous chlorine. It affects the digestive organs less than simple Iodine.

For diuretic purposes, it should be administered either in solution in water or in the form of the compound solution with Iodine. In simple solution, the usual dose is from gr. ii to ℈i; but it may be given in doses of ʒss. I have seldom observed

much advantage obtained, unless the larger doses were administered.

2. Chloride of Barium. *Barii Chloridum.* L. *Baryta Murias.* E. D.—This salt is prepared, according to the London and Edinburgh Colleges, by dissolving the Carbonate of Baryta in Hydrochloric Acid by the aid of heat, filtering the solution, and crystallizing. The Edinburgh College has, however, a second process, which has been adopted by the Dublin College, in which the Sulphate of Baryta, heated to redness and pulverized, is mixed with charcoal and subjected to a low white heat for three hours in a covered crucible. The product, in powder, is boiled in successive waters, and hydrochloric added to the mixed solutions, as long as any effervescence is produced. The liquor is lastly strained, evaporated, and crystallized. The constituents of the salt are 1 eq. barium = 68·7, + 1 of chlorine = 35·42, + 2 water, = 18 equiv. = 122·12 (B. C. + 2 H. O.). Although the diuretic influence of this salt has been ascertained, yet it is very seldom prescribed as a diuretic. It has been found serviceable in old worn-out asthmatic habits, in which the disease displays a tendency to terminate in hydrothorax. In such cases, the tonic influence of the chloride maintains the strength of the patient while he is under its diuretic influence. The dose of the solution, made with one part of the chloride and eight parts of water, is from three to twenty minims. It is incompatible in prescriptions with sulphates, citrates, and astringent vegetable infusions and decoctions.

3. Nitrate of Potassa. *Potassæ Nitras.* L. E. D. *Nitre* (p. 370).—This salt passes unchanged to the kidneys, which it stimulates to increased action, augmenting the flow of the urine: it may be detected in that secretion. The doses in which it is administered, to produce its diuretic effects, are from ℈ii to ʒi: it requires to be largely diluted.

4. Chlorate of Potassa. *Potassæ Chloras.* L.—When a stream of Chlorine is passed through a solution of fifteen parts of carbonate of Potassa, in thirty-four parts of water, a decomposition of the alkali takes place, and the metal attaches itself to one portion of the Chlorine, and forms chloride of potassium, whilst the oxygen of the Potassa unites with the remainder and forms chloric acid, which combines with the undecomposed Potassa, and forms Chlorate of Potassa, that crystallizes in the solution, falling down in the form of pearl-white rhomboidal plates or scales. Pure Chlorate of Potassa is procured in tabular, four or six-sided crystals, of a pearly lustre, and impressing a cooling taste, resembling that of nitre, on the palate. These crystals are permanent in the air; they fuse in a strong heat, giving out the oxygen of their acid, and being converted into chloride of potassium. Their constituents are 1 eq. of potassa = 47·15, + 1 chloric acid 75·42, equiv. = 122·57 (Cl. $O.^3$ + K. O.). It is

readily decomposed by all the mineral acids, common salt, and nitrate of silver, all of which are incompatible with it in prescriptions. As a Diuretic, Chlorate of Potassa operates directly on the kidney, acting nearly in the same manner as nitrate of potassa, but with much less energy. It is now seldom employed, even as a Diuretic; as which, however, it has some claims on our confidence. It may be given in doses of from gr. v to ℈i, in infusion of broom or juniper tops, or in any bland fluid.

2. DIRECT DIURETICS, UNDERGOING DECOMPOSITION IN TRANSITU.

Organic Products.

a. Animal.

f. CANTHARIDIN.—This substance is procured by the following process from the soft parts of the Spanish fly, Cantharis *vesicatoria*, and of the Mylabris *variabilis*, and *cichorii* and Lytta *vittata*. Prepare an alcoholic tincture by percolation, concentrate it, and set it aside; as the evaporation proceeds, the Cantharidin crystallizes. It is purified from the resinous matter adhering to it by washing with cold alcohol, and afterwards boiling it in alcohol with animal charcoal. It is a white substance, in minute, micaceous scales, fusible at 210°, and subliming in acrid crystallizable vapours in a higher temperature. It is insoluble in water and in cold alcohol; but soluble in boiling alcohol, in ether, and in oil. The knowledge of its solubility in oil is a fact of much practical importance. It may be regarded as a resinoid. It is a compound of 61·68 per cent. of carbon, + 6.04 of hydrogen, + 32·28 of oxygen, = 100·00*. This substance has not yet been employed in its free state as a Diuretic.

The BLISTER BEETLE, *Cantharis*, L. E. D. from which Cantharidin is procured, is a Coleopterous insect. It is oblong, nearly parallel for two thirds of its length, and then tapering to the extremity. It is about two thirds of an inch long, and a quarter of an inch broad: the elytra or wing covers are green, shining, and tinted with a golden hue; the wing sheaths are marked with three longitudinal raised stripes; the wings are brown, membranous, and transparent. The body is terminated with two small, callous, sharp spines; the head, which is gibbous, bears two black, jointed, thread-like feelers, and along the head and the chest there is a longitudinal furrow. It is of some importance to know the real character of the Blister Beetle, as the specimens of them are frequently mixed with the Melolontha,

* Regnaud.

Scarabæi, Cetoniæ, and other beetles*. It is a curious fact that the circulating, respiratory, and nervous system of this insect, in conjunction with the generative organs, have a singular analogy with those of the vertebrated animals. This beetle is found in every part of Europe where the vine flourishes naturally in the open air, that is, from the equator to the 52nd degree of northern latitude†: it has also been seen in the South of England, and is abundant in the Southern provinces of Russia‡. It feeds upon the ash, the privet, the lilac, the honey-suckle, the rose, willow, poplar, and elm. When it is very abundant, an odour resembling that of the mouse is exhaled; and it is probable that the cause of the ardor urinæ and ophthalmia, experienced by persons who sit under a tree containing many of these insects, during the time of their copulation§, is to be attributed to the Cantharidin being carried off with the volatile oil which causes this odour. Ophthalmia is severely felt by those who prepare Cantharidin, unless the eyes be protected by gauze shades.

For medicinal purposes, Cantharides are collected in May, the period of their copulation, by shaking them, at dawn, when they are torpid, from the trees upon which they settle, and catching them on cloths; they are then killed by the vapour of boiling vinegar—a process as ancient as Dioscorides, who describes it. Sometimes they are killed by dipping the cloths on which they are collected into vinegar and water, after which they are dried by exposure to the sun. During the drying, the insects require to be frequently turned; and if the hands of those who perform this operation be not guarded with gloves, great pain is felt at the neck of the bladder, and strangury and ardor urinæ supervene. When properly dried, Cantharides preserve their active properties for more than thirty years. They are often attacked by a small mite or acarus, which, devouring the soft parts, leaves only the hard parts, or the shell of the insect, thus rendering it nearly inert. The only method to stop the depredations of this parasite is to put a little pyroligneous acid into the bottle containing the Cantharides; or some carbonate of Ammonia; or to kill the beetle with oil of Turpentine instead of Vinegar.

Many experiments have been made to determine on what the active principle of the insect depends. Dr. Zeer ascertained that the ovaries, the external genitals, and the intestines, contain

* To those who have time and taste for pursuing inquiries in natural history, I would recommend the perusal of an admirable paper on the Anatomy and Organization of the Blister Beetle, in the *Annales des Sciences Naturelles*, for 1826, accompanied with excellent figures of the parts.

† They were formerly imported chiefly from Spain, whence their name, Spanish flies; but Dr. Pereira informs us that they are now brought from Messina and St. Petersburgh.

‡ Pharm. Castr. Ruthenica, 1840, p. 243.

§ The males die after this act, the penis being left in the vulva of the female.

the most active matter for blistering; the muscular parts, the thorax, and the exterior parts of the body, contain much less; the wing sheaths, the antennæ, and the feet, the smallest quantity, but still some. This accounts for blistering plaster thick with the bright green elytra proving almost inert. Thouvenel, in 1778, first endeavoured to ascertain the nature of the active principle of this insect by chemical analysis. He treated the entire insect with water, alcohol, and ether, submitting each infusion and tincture separately to the press. He obtained—1, one half of the weight of the insect of a *parenchymatous matter*, which he did not examine: 2, three-eighths of a *reddish-yellow extract*, very bitter, and affording, when distilled, an acid liquor; 3, *a concrete yellow matter*, which he compared to the pollen of flowers; 4, one-tenth of *green, waxy concrete oil*, which smelt strongly of the insect, and yielded, when distilled, a *sharp, acrid, thick oil*, which he conceived to be the active principle of the insect.

In 1803, Beaupoil extended the analysis of Thouvenel: he found that the acid of the parenchymatous matter is the *phosphoric*. On submitting the precipitate, which falls, in an aqueous infusion of the insects exposed to the air, to the separate action of alcohol and ether, he obtained 12·94 of a *black, gluey matter*, insoluble in alcohol, but soluble in water, which blistered without affecting the urinary organs; 12·94 of a *yellow matter*, soluble in water, ether, and alcohol, which did not blister unless united with the wax, but produced virulent poisonous effects when introduced into the circulation; 13·99 of *green oil*, soluble in alcohol and ether; 60·13 *Parenchyma, salts, and oxide of iron*, and a trace of phosphoric acid, = 100·00.

In 1810, a new analysis was undertaken by Robiquet. He boiled slightly-bruised Cantharides in distilled water, and obtained a brownish-red solution, which reddened litmus, and was highly vesicant. By repeated boilings, he obtained all the soluble matter of the insect: and, having treated the dried residue with alcohol, he obtained a green tincture, which, by evaporation, left a *green inert fluid oil*, soluble in alcohol; proving that Thouvenel was mistaken in attributing the active principle to this oil; on evaporating the aqueous decoction and treating the residue with alcohol, he obtained a *black insoluble* and a *yellow soluble matter*: the former not vesicant, the latter powerfully vesicant. On treating this yellow matter with ether, small *micaceous crystalline plates* formed, which were powerfully vesicant when dissolved in fixed oil. This principle he regarded, justly, as the active part of the insect. Robiquet found also that the insect in its recent state contains a little *lithic acid, acetic acid, phosphate of lime*, and *magnesia*, forming the bases of the horny parts; and a *concrete fixed oil*, besides *volatile oil*, which Orfila states is combined with and aids the medicinal powers of the

active principle. Dr. Thomas Thomson named the active principle *Cantharidin.* Robiquet demonstrated the powerful vesicant property of *Cantharidin,* which leaves no doubt respecting its being the active principle of the Blister Beetle.

The Blister Beetle is justly regarded as a direct stimulant Diuretic, when administered in doses not sufficient to excite inflammation of the alimentary canal. These diuretic properties of this insect were known to Hippocrates, who prescribed them in dropsy and amenorrhœa. A very celebrated Diuretic, also, that of Tulpius, consisted of a tincture of Spanish flies, tincture of Cardamoms, and sweet spirit of nitre. The effects of this insect upon the urinary organs were also very generally known in oriental countries, and in the south of Europe, in which it was used as an *aphrodisiac;* but, unless they were employed with the greatest caution, the voluptuary who swallowed the powder bought his momentary gratification by pains and suffering of a very acute description: and it is doubtful whether the anticipated effect was obtained. Like many other popular beliefs, it seems to rest upon a very doubtful foundation. It is, nevertheless, true that Cantharides, internally administered in large doses, causes priapism, which is occasionally, not always, accompanied with satyriasis. It was probable that the violence of these results of the internal use of the Cantharides tended to prevent it from being much employed as a Diuretic*.

When Cantharides are swallowed, they are partially digested, and the Cantharidin is, probably in conjunction with the oil, received into the circulation. But whether it be this principle, or the entire matter of the insect, in minute division, that is absorbed and conveyed to the kidneys, its influence upon these organs is stimulant; and, when large doses are administered, may amount to acute inflammatory action, producing bloody urine, insupportable pains in the abdomen, strangury, vomitings, convulsions, delirium; and frequently the issue is fatal. The post-mortem examination of the body displays inflammation not only in the urinary and genital organs, but in the mucous membrane of the alimentary canal. When administered in proper doses, namely, one or two grains, Cantharides stimulate the kidneys and cause an increased flow of urine. Their effect is stimulant in the first instance; but this is transitory, and, whilst there is a copious increase of the urinary discharge, neither heat of the kidney nor strangury is experienced. They have been

* Cantharides, besides forming the celebrated lithontriptic of Tulpius which I have noticed, were also long prescribed for the cure of gleets by the Sicilians; yet, in 1693, Dr. Groenvelt was committed to Newgate by a warrant from the president of the College of Physicians, for prescribing them internally. Quincey, in relating this anecdote, adds, that this act, which ruined the unhappy doctor, taught the safety and the value of his practice. He published a work on the subject, De tuto Cantharidum in Medicina usu interno, 12mo. London, 1698.

found extremely useful, when administered as a Diuretic, in scaly affections of the skin: but this is the result rather of the general stimulus given to the capillary system, than of their diuretic power. They have been employed with success in the ascites of old worn-out constitutions. It is requisite, during their employment, to dilute freely with bland fluids. If strangury occur, the best mode of relieving it is to throw into the rectum a pint of warm water, containing from twenty to sixty minims of laudanum. Notwithstanding the safety and advantage with which they may be internally administered, they have not been much employed; and indeed, when we consider that many individuals suffer considerably, even from the absorption of such minute portions as can be taken up from a blistering plaster, the danger of an incautious employment of them internally is sufficient to set aside their general administration.

When Cantharides have been accidentally taken in large doses, the best mode of counteracting the dangerous symptoms is to administer emetics, to bleed, and to dilute copiously with bland, demulcent drinks. The use of oil must be carefully avoided; for, as oil is the best solvent of Cantharidin, the poison is only the more widely diffused, and consequently it is rendered more extensively hurtful. Many of the cases of poisoning by Cantharides have arisen from the poison having been swallowed with the view of exciting the venereal appetite; for, as in many cases this effect has not followed the ordinary dose, large doses have been swallowed. The greater number of the cases detailed by toxicological writers have not terminated fatally, although the sufferings of the patients have been most severe. In some instances, the inflammation of the genital organs has run on to gangrene; which was the case in a fatal instance noticed by Ambrose Paré, which was caused by a young woman seasoning comfits for her lover with Cantharides. In some instances, phrenitic symptoms, with tetanic convulsions and hydrophobia, have been the consequence of overdoses of the tincture.

Of late years, another insect has been introduced into practice, as a substitute for the Cantharides, which appears to possess all its vesicant and diuretic properties. This is a species of the genus *Mylabris*, one species of which, the M. *Chicorii*, a native of the south of France, Italy, and Greece, was employed by the ancients, and is described both by Dioscorides and Pliny. Pliny says it was used in the same manner as the blister beetle. The genus Mylabris consists of fifty-one species, of which twenty-eight are found in Africa. The species employed as a substitute for Cantharides is the Mylabris *variabilis*. It is brought from China, and is regarded rather as a variety of the M. *Chicorii* than a distinct species. M. Robiquet has analyzed it, and has found that it affords Cantharidin in as great abundance as the Cantharides. It acts with as much energy as a vesi-

cant as the best Cantharides. Another species of Mylabris, the M. *pustulata* of Olivier, is also used as a vesicant in China. Some species of Meloe, the *Proscarabæus* and *Majalis* in particular, also contain Cantharidin; they may be used both as vesicants and diuretics. If an easy method of obtaining Cantharidin were discovered, its use might supersede that of the entire insect. The powder of Cantharides is now seldom used as an internal medicine; and the tincture, which is undoubtedly the best preparation of the insect, is also the most generally employed.

Tincture of Cantharides. *Tinctura Cantharidis.* L. E. D. —Take ℥ss of Cantharides, and Oii (f℥xlviii, D.) of Proof Spirit. Digest for fourteen (seven, E. D.) days, strain, express strongly the residuum, and filter the liquor. If the Cantharides be reduced to coarse powder, and be formed into a pulp with a little of the spirit, and left for twelve hours, the tincture may be then obtained very conveniently and expeditiously by percolation. The dose of the Tincture is from m. x to m. xl. I have carried it to f℈i, in Decoction of Elm Bark.

Vegetable Products.

g. OLEO-RESINS AND VOLATILE OILS.

It is doubtful whether the Oleo-resins pass entire through the kidneys, or whether the volatile oil only, which is undoubtedly the active principle, is separated from the resin by the digestive process, and passes into the circulation. The latter is the most probable opinion.

1. Copaiva. *Copaiba.* L. E. D. *Copaibæ Oleum.* E.—Oil of Copaiva (p. 824).—The diuretic properties of Copaiva closely resemble those of turpentine. In moderate doses, it excites the natural functions of the kidney, and increases the secretion of urine: in overdoses, it causes inflammation of the kidneys: consequently its employment should be avoided when there is the least tendency to ulceration of these organs. It may be exhibited in either a fluid or a solid state. Its solidification may be effected, by means of its combination with an alkali, into a soap, which does not diminish its powers, whilst it permits it to be formed into pills, which may be given in doses of from gr. x to ℈i. The fluid Copaiva may be given in doses of from m. xv to m. lxxx, in water, suspended by means of mucilage. The volatile oil, separated from the Copaiva by distillation, may be formed into an oleo-saccharum; and, in this form, its dose is from m. v. to m. xxx.

2. Cubebs. *Piper Cubebæ* L. D. *Cubebæ.* E. (p. 63.)—When taken into the stomach, Cubebs are probably partially digested, and the volatile oil, which forms their active principle, is separated and passes into the blood. This oil closely resembles that of turpentine; it is, therefore, unnecessary to make any re-

marks on its chemical properties. The oil of Cubebs differs from most of the other volatile oils in the degree of its volatility; indeed, the escape of the oil, owing to its great volatility, is the cause why the powder of Cubebs so quickly loses its activity.

In moderate doses, Cubebs are diuretic; in larger, they are purgative. In the former case, the oil can be detected in the urine by the odour, in a manner similar to that of turpentine. The chief disease for the relief of which Cubebs have been employed in this country is gonorrhœa; but I have occasionally used them in other inflammations of the mucous membranes. In doses of from ten to twenty grains, I have found them useful in chronic inflammation of the mucous membrane of the bladder. Their beneficial effects evidently arise from the volatile oil entering the circulation, and stimulating not only the kidneys to increased action, producing an augmented secretion of urine, but also passing on to the bladder with the urine, and acting in the same manner there as on the urethra in gonorrhœa, in allaying the inflammation of the mucous membrane of that organ. To secure the effects of Cubebs, the pepper should be well preserved in close vessels, and ground or powdered a few hours only before it is administered, so as to retain as much of the oil as possible. For the same reason, it is more beneficial to administer them in the form of powder than in that of tincture. To obtain their diuretic effects, the dose should exceed half a drachm, and be repeated at moderate intervals; at least four times in twenty-four hours. The distilled oil may be employed in doses of from m. x to m. xxx, in the form of an eleo-saccharum.

TINCTURE OF CUBEBS. *Tinctura Cubebæ*. L. *Tinctura Piperis Cubebæ*. D.—Macerate ʒv (℥iv, D.) of Cubebs, in Oii of rectified (f℥xvi, proof, D.) spirit for fourteen days, and filter. Dose, fʒi to fʒii.

BUCHU. *Diosmæ*. L. *Bucku*. E. *Diosmæ Crenatæ Folia*. D.—The beautiful little plant yielding these leaves is found not to belong to the genus Diosma, as the London College has assumed, but to be a species of a new genus, which has been termed *Barosma*. Our plant is the Barosma crenulata; but the leaves sent home under the name *Buchu*, are most probably the production of several species of the genus. The genus belongs to the natural order Rutaceæ*. The plant is a native of the Cape of Good Hope. It is a small, upright shrub, from two to three feet in height; the leaves are on short petioles, about an inch long, oval-lanceolate, obtuse, minutely crenated, glabrous, rigid, dark-green on the upper disk, paler and smooth, with a few oblique glands, and studded with pellucid glands, beneath. There are also glands at the crenatures, and a pellucid margin round the leaf. The flower, when fully expanded, consists of five ovate,

* Bot. Mag. t. iii, 413. Lindley, 212.

bluish petals; with a calyx consisting of five ovate-acuminate leaflets, green, tinged with purple*. By the inexperienced eye, the leaves of Buchu might be mistaken for leaflets of senna. They exhale a powerful but agreeable aromatic odour, and impart a taste not unlike that of peppermint, leaving a sweetness and pungency on the palate. By distillation, a volatile oil is obtained, which has the odour of a mixture of camphor and rue. According to the analysis of Felix Cadet de Gassicourt, Buchu Leaves contain 0·665 parts of *volatile oil*, + 21·170 of *gum*, 5·170 of *extractive*, + 1·100 *chlorophylle*, + 2·151 *resin*, + *lignine* 69·744, = 100 parts†. The active principles are the oil and resin, which are taken up both by boiling water and proof spirit.

Buchu Leaves have decided diuretic properties, combined with a tonic power. They are administered in the forms of powder, infusion, and tincture. The dose of the powder, ℈i to ʒss.

INFUSION OF BUCHU, *Infusum Diosmæ*, L. *Infusum Bucku*, E. D. is made by infusing ℥iss (℥ss, D.) of Bucku in Oi (f℥viii, D.) of boiling water, in a covered vessel, for four (two, E.) hours, and straining through linen or calico. Ten fluid drachms are given for a dose, which should be repeated every four hours.

TINCTURE OF BUCHU. E. D.—Digest for seven days ℥v (℥ii, D.) of Buchu in Oii (f℥xvi, D.) of proof spirit; pour off the clear liquor and filter. It may be also made by percolation. The dose is fʒi to fʒii.

h. COLCHICIA.

CORMUS AND SEEDS OF COLCHICUM (p. 447). *Colchici Cormus et Semina*. L. E. *Colchici Bulbus et Semina*. D.—In the same manner as the stomach separates the volatile oil in cubebs and juniper, it separates the Colchicia from the Colchicum, and the former passes into the circulation and stimulates the kidneys. But Colchicum also purges; which requires some explanation, the action of a Diuretic being in direct variance with that of a purgative: it is owing to its acting, when in full doses, powerfully on the duodenum, and bringing down a large quantity of bile into the bowels, which purges; in small doses, it is taken into the circulation and operates on the kidney. As a Diuretic, it was given with much success by Störck, long after its use as a remedy in gout became obsolete. It must, however, be acknowledged, that, as a Diuretic, Colchicum is much less powerful in its influence upon the kidneys than the squill—a circumstance depending undoubtedly on its disposition to run off by the bowels. For producing diuresis, tincture is the best form of it. In this form, it operates mildly; but, when it is combined with vinegar or white wine, the acetic acid renders the Colchicia more soluble than in

* Hooker. † Journ. de Chim. Med. iii, p. 44.

its natural combination; thence it passes the pylorus and excites the peristaltic action of the intestines. The seeds and the petals of the flower also contain Colchicia, and have been employed for the same diuretic purposes as the cormus. The dose of the cormus in substance, as a Diuretic, is from three grains to twelve; but the tincture or the wine are preferable when the diuretic influence of the drug is required.

COMPOUND TINCTURE OF COLCHICUM, *Tinctura Colchici composita*, L. is made by macerating ℥v of bruised seeds of Colchicum in Oii of Aromatic Spirit of Ammonia for fourteen days, and then straining. The dose is fℨss to fℨi.

WINE OF COLCHICUM. *Vinum Colchici.* L. E.—Macerate for fourteen (seven, E.) days ℥viii of Colchicum Cormus, dried and sliced, in Oi of Sherry Wine; then strain, or express strongly the residue. The dose is fℨss to fℨi. The wine made with ℥ii of the seeds and Oi of Sherry, macerated for eight or ten days, as directed by Dr. Williams, is preferable to the wine of the Cormus. The dose is fℨss to fℨii.

The diuretic powers of Colchicum are not such as to enable the practitioner to rely with confidence on its influence in removing morbid accumulations of fluid by the kidneys; and where it has proved useful, it has had little influence on the intestinal canal.

i. SCILLITINA.

SQUILL, *Scilla.* L. E. D. (p. 745.)—Squill has been employed as a Diuretic from the earliest antiquity. The Egyptians administered it in dropsies, under the name of the *Eye of Typhon;* and it is mentioned as an hydropic Diuretic both by Theophrastus and Dioscorides. It is one of the best of our vegetable Diuretics. It is generally given in substance, although seldom alone, being combined with calomel, or the blue pill, or the bitartrate of potassa. If a full dose be given at first, it is apt to excite nausea and vomiting; it is, therefore, preferable to begin with a small dose—one grain, for example—repeated every sixth or eighth hour, and gradually to increase the dose to six grains, or until some degree of nausea be induced. When it is combined with mercury, the excretion of urine is always more rapidly augmented; but whether this depends on the action of the mercury on the capillary system generally, or whether, by this combination, the active principle of the Squill is more readily separated by the stomach, I will not venture to determine. Calomel is the best addition to Squill, to promote its full diuretic effect. Cullen recommends the bichloride of mercury; but every intention is answered by calomel, with much less chance of griping than the bichloride is apt to produce. The advantages of the combination of Squill with mercurials are still greater when the source of the deposition of the fluid in the serous cavities is the obstruction of the liver or any of the abdominal

glands. If the Squill purge when combined with mercurials, it should be either altogether discontinued, or the mercurial applied in the form of friction; but this direction is not peculiarly applicable to Squill, as it is a law of the system that purging and diuresis cannot exist at the same time.

In some habits, owing to idiosyncracy, the use of Squill excites an eruption on the skin not unlike that caused by the stings of nettles, accompanied with severe gripings, cold sweats, and occasionally convulsions. When this is the case, the medicine must be discontinued, and cordials with opium exhibited. It is also probable that as the alkaline carbonates, infusion of galls, and sulphate of iron, throw down precipitates in mixtures containing the tincture of Squill, the sulphate of iron may prove an antidote when Squills are taken in an overdose; but this requires to be confirmed by experience. The dose of Squill, in substance, when well dried, should not exceed eight or ten grains. It is most useful in small doses frequently repeated.

k. SUBSTANCES CONTAINING PRINCIPLES NOT CORRECTLY ASCERTAINED.

Roots.

ROOT OF SARSAPARILLA, *Sarza*. L. E. *Sarsaparilla*. D.—This root has had a greater variety of fortune than any other substance contained in the list of the Materia Medica, having been sometimes in the highest degree of favour, at other times in the lowest state of degradation as a remedial agent. It has long been the custom to regard it as the root of Smilax *Sarsaparilla**; there is some reason, however, for supposing that the roots of S. *officinalis*, S. *syphilitica*, S. *medica*, and S. *cordato-ovato*, yield the commercial root. The root is the part employed; but it is attached to a rhizome. The genus belongs to the natural order Smilaceæ. These plants are natives of the northern region of South America and of Virginia. It is said that the best Sarsaparilla grows on the borders of a lake on the north of the Cerra Unturan, not far from Esmeralda.

The Sarsaparilla imported into Britain is named from the places of export. 1. That which is termed *Lisbon* is the produce of Brazil; and is the root of the S. *syphilitica* and S. *ovato-cordato*. It is much esteemed, and brings a high price in the market. Its epidermis is of a dull red colour, marked with slight longitudinal striæ, and free from radicle fibres. The interior is very white, and seemingly formed entirely of fecula. Its taste is bitterish. 2. The *Jamaica*, which has been lately brought into notice, is a subvariety of the Lisbon†. It is cha-

* Woodville's Med. Bot. t. 62. Lindley, 259.

† Mr. Pope, in a paper on Sarsaparilla, published in the 12th volume of the Medico-Chirurgical Transactions, regards it as the uncultivated root of this variety,

racterized by a reddish-brown coat, and, when divided longitudinally, has a kind of spongy or farinaceous aspect. It is more bitter and aromatic, and less free from fibres, than the other variety. The plant yielding it is yet undetermined. 3. What is termed *Lima* Sarsaparilla is exported from Valparaiso, and closely resembles the *red*, or Jamaica, for which it is often sold. The rhizome is always present in the bundles; the colour of the roots is greyish-brown. It is supposed to be the root of S. *officinalis*. 4. The *Honduras* is the next in point of estimation. Its characteristics are a dirty brown, sometimes whitish cuticle; it is darker than the Jamaica, usually displays few radicles, and has a more woody pith than the three other varieties. 5. The *Vera Cruz* is less fibrous than either of the others; but it is less esteemed. It is referred to the S. *medica*, a plant found in Vera Cruz*.

The roots of Sarsaparilla, whatever may be the variety, are inodorous, and have a bitterish, mucilaginous taste. The efficacious part is the bark, the axis or heart being mere ligneous matter, perfectly inert. The bark yields all its soluble matter to cold water, but more readily to boiling water: it is also said to yield it to lime-water and to water saturated with pure potassa.

According to the experiments of Mr. Pope, equal quantities by weight of the different kinds of Sarsaparilla, when infused in distilled water, and the solutions filtered through paper, afford the following comparative proportion of hard extract. Each was successively treated with hot and cold water. The Jamaica afforded 64 parts; the finest Lisbon, 42; the Honduras (finest), 48.

When equal quantities of the cortical part and of the wood were separately submitted to infusion in boiling distilled water, the proportions were—

Of the bark of the Jamaica......	100
the wood of the same	20
Of the bark of the Honduras ...	48
the wood of the same	24

The watery infusion of Sarsaparilla has a brown colour, nd is precipitated by infusion of galls; but this precipitate is redissolved when the infusion is heated: it is a tannate of fecula. This infusion is not affected by protosulphate of iron; but it is precipitated by acetate of lead and nitrate of mercury. Pfaff† analyzed Sarsaparilla, and obtained 2·0 parts of a *balsamic resin*,

whilst that which is called Lisbon is a cultivated root of the same variety. It grows on the Spanish Main of South America.

* The root of Hemidesmus *indicus* was brought to this country in 1831-2 by Dr. Ashburner, and was sold as the root of Smilax *aspera*, an Egyptian plant, described by Prosper Alpinus, *de Plantis Ægypti*, p. 141. The S. *aspera* possesses little to recommend it to modern practitioners.

† Syst. de Mat Med. Bot. vii, § 90, 1824.

2·5 of *acrid extractive*, 3·7 of *a substance resembling cinchonia*, 9·4 of *common extractive*, 1·4 *of gum*, 2·2 of *albumen*, 3·0 of *water*, and 75 of *woody fibre*, in 100 parts. Another chemist, Cannobio *, obtained—2·8 of *bitter acrid resin*, 5·5 of *gummy extract*, 54·2 of *starch*, 27·8 only of *woody fibre*, 9·7 of loss, in the same quantity of Sarsaparilla. Whilst a third, M. Battka †, procured—1, a *crystallized acid*, which he has named *Parillinic*; 2, an *essential oil*; 3, *gum*; 4, *Lassorine*; 5, a *colouring crystallized matter*; 6, *starch*; 7, *albumen*; 8, *extractive*; 9, *gluten and gliadine*; 10, *pectic acid*; 11, *acetic acid*; 12, *saline matter*, consisting of *chlorides of calcium, potassium*, and *magnesia*; *carbonate of lime, oxide of iron, alumina*; *and*, 13, *lignine*. He regards the parillinic acid as the active agent. He thus describes it:—it resembles the scales of fish, and, when fined, acquires the aspect of brownish resin; in a high temperature, it exhales a peculiar odour, and is carbonized. It is soluble in alcohol; scarcely soluble in cold water; and only sensibly so in boiling water; it is precipitated in gelatinous masses by chloride of calcium and the mineral acids. It differs from pectic acid in dissolving, unchanged, in nitric acid. It is not easy to reconcile these discrepancies. An Italian, M. Galileo Pallota, had separated, by a very operose process, an alkaloid substance from Sarsaparilla, which he supposed is the active principle of the root; and he named it *Pariglin* ‡. This substance is a white, pulverulent, light, saline body, of an austere, slightly astringent, nauseous taste, with a peculiar odour. It is soluble in hot water, slightly soluble in cold alcohol, but very soluble in hot alcohol: its solution reddens turmeric paper; it forms a sulphate when conjoined with diluted sulphuric acid; but the strong acid decomposes it. It forms neutral salts with the other acids. According to Poggiale, it is a compound of 62·53 of carbon, + 28·8 of oxygen, + 8·67 of hydrogen, = 100·00, or $C.^{8}\ H^{7\frac{1}{2}}.\ O.^{3}$ Another Italian, M. Folchi, has also claimed the discovery of the active principle of Sarsaparilla, which he asserts resides in the woody or central part: he regards it as a vegetable alkali, and has named it *smilacin*; but Poggiale has demonstrated that *pariglin, salseparin, paralinic acid*, and *smilacin*, are identical §. I am, indeed, very sceptical as to the claims of any of these products.

* Brugnatelli's Giorn. di Fisica, 1818, vol. i, 421.
† Journ. de Pharm. t. xx, p. 43.
‡ It is obtained from a concentrated alcoholic solution of Sarsaparilla, procured by percolation. Most of the spirit is distilled off, after which the remaining tincture is decolorized with acetate of lead in excess. The lead is then to be removed with sulphuric acid; the filtered solution concentrated to crystallization; and the crystals purified by repeated solution and crystallization.
§ Journ. de Chim. Med. 2d ser. tome i, p. 45.

Sarsaparilla affects the secretion of the kidneys: it is probably partially digested, and sends only the active principle, whatever this may be, to the kidneys; but nothing is known upon this subject. It was early introduced into notice for the cure of syphilis: and, in the sixteenth century, Fallopius extolled its powers as preferable to mercury. He denominates the cure by Sarsaparilla the royal road to health, the via regia, and condemns the mercurial treatment as harsh and severe: "omnium," says he, "curationum acerbissima." Fallopius did not stand alone in this opinion; but, nevertheless, the medicine fell into disrepute, and was not again brought into notice until the middle of the last century, when Dr. William Hunter and Dr. Fordyce again restored it to favour, but not as a remedy for primary syphilis. Its real utility in this disease has been fixed by Mr. Pearson, who regards it as useful after a course of mercury, to free the habit from what may be regarded as the sequel of such a course; and Mr. Lawrence and Mr. Bacot, authorities of considerable weight in every thing relating to syphilis, remarks that "there is no medicine in the whole materia medica comparable to the Sarsaparilla for the purpose of restoring the tone of the stomach and recruiting the broken-down constitution." It certainly possesses the power of improving the general state of the system, and restoring the vigour of the constitution when broken down either by long-protracted disease or by an extended course of mercury. What part of this benefit is to be attributed to the diuretic influence of the root, I will not venture to determine. That beneficial effects result from the use of Sarsaparilla, experience has fully demonstrated; but perhaps no medicine that is so frequently ordered is prescribed so much on what are termed empirical principles; neither the active principle of the medicine nor the mode in which it operates being yet understood. The *parillinic acid* of Battka, the *pariglin* of Pallota, or the *smilacin* of Folchi, may be the active principle of Sarsaparilla; but none of them has been yet examined in this country; nor have they attracted much attention even on the Continent. M. Planché stated, in 1824, that he had repeated the experiments of Pallota; but had not, at that time, verified all the properties said to belong to *pariglin*. In the 18 years which have elapsed since that time, nothing has been done with respect either to pariglin or to smilacin. In whatever form Sarsaparilla is administered, it is necessary to give it in large doses: a pint of the decoction, an ounce of the powdered root, and from two scruples to three drachms of the solid extract, must be taken in the course of the day, and should be continued for many weeks.

In the preparation of the decoction, much unnecessary maceration and boiling are ordered in the Pharmacopœia. The experiments of Mr. Battley have demonstrated that the bruised

root yields all its active and soluble matter to water at 180° Faht. and that much boiling is unnecessary.

The great expense of Sarsaparilla has induced substitutes to be proposed for it. For this purpose, the roots of the Aralia *nudicaulis*, a root indigenous in the United States of America, have been used. They resemble the Lisbon Sarsaparilla in their external characters; but may be distinguished by being marked with purplish dots, and having no ligneous, central part. I have occasionally seen this root mixed with the split Sarsaparilla of the shops: and the roots also of the Agave *Cubensis*, which resemble the red Sarsaparilla. An Indian Sarsaparilla, which was supposed to be the root of the Smilax *aspera**, but is that of Hemidesmus *Indicus*, as already mentioned, was introduced a few years since, and is a good substitute for Sarsaparilla. I have for some years past employed Elm Bark, in dispensary practice, instead of Sarsaparilla: it produces a decided effect upon the kidneys; but it does not act in restoring the vigour of the habit so effectually as Sarsaparilla. Besides *ulmin*, a peculiar principle which is found in the bark of many trees, Elm Bark contains much carbonate of potassa in combination; and probably a great part of its diuretic effects may depend on the union of the ulmin and the potassa.

The preparations of Sarsaparilla are Infusion, Decoction, Extract, and Syrup.

Compound Infusion of Sarsaparilla, *Infusion Sarsaparillæ compositum*, D. is made by macerating ℥i of Sarsaparilla, washed with cold water and sliced, in Oi of Lime Water, for 12 hours, in a close vessel, shaking it occasionally and straining. The dose is f℥i to f℥iv. In Mr. Batley's opinion, Lime Water is a bad menstruum†.

Decoction of Sarsaparilla. *Decoctum Sarzæ*. L. E. *Decoctum Sarsaparillæ*. D.—Take ℥v (℥iv, D.) of sliced Sarsaparilla; boil in distilled water Oiv (old wine measure, D.). Digest the root in the water for four hours, in a vessel lightly covered, near the fire; then take out and bruise the Sarsaparilla; return it to the liquor, and again macerate for two hours; lastly, boil down to Oii, and strain. Much boiling is supposed to injure Sarsaparilla. The dose is f℥iv to f℥viii.

Compound Decoction of Sarsaparilla. *Decoctum Sarzæ compositum*, L. E. *Decoctum Sarsaparillæ compositum*, D.—Take Oiv of the simple decoction, boiling hot; Sassafras, sliced and bruised, Guaiacum-wood shavings, Liquorice-root, bruised, of each ʒx (℥i, D.), Mezereon, ʒiii (℥ss, E.). Boil for a quarter of an hour and strain. The decoction, which is intended as a substitute for the *Lisbon Diet Drink*, possesses no advantage over the simple decoction: and both are inferior to the powders. The dose is f℥iv to f℥vi, three or four times a day.

Extract of Sarsaparilla. *Extractum Sarzæ*. L. *Extractum Sarsaparillæ*. D.—The London College orders lb. iiss of sliced

* Roxb. Fl. Ind. ii, p. 39. Lindley, 543. † Lond. Med. Rep. xix, 169.

Sarsaparilla to be macerated in cong. ii of boiling distilled water for 24 hours, then boiled down to a gallon, and the liquor strained while hot, and evaporated to a proper consistence. Dose, ʒss to ʒii.

The Dublin College, lb. i of sliced Sarsaparilla, to be infused for 24 hours in a gallon of boiling water; then boiled down to lb. iv, the liquor strained whilst it is hot, and, lastly, boiled down to a proper consistence. Dose, gr. x to ℈i.

FLUID EXTRACT OF SARSAPARILLA. *Extractum Sarzæ fluidum.* E. *Extractum Sarsaparillæ fluidum.* D.

The Edinburgh College orders lb. i of sliced Sarsaparilla to be digested in Oiv of boiling water; then taken out, bruised, replaced in the water, and boiled for two hours. The liquor is then to be squeezed and filtered; and the residue boiled in Oii of water, and treated as before. The liquors are to be now mixed, and concentrated to the consistence of a thin syrup; and when the product is cool, as much Rectified Spirit added as will make in all f℥xvi.

The Dublin College, lb. i of sliced Sarsaparilla to be boiled for an hour in Ovi (old wine measure) of water; the liquor to be poured off, and the residue again boiled in the same quantity of water; the liquor poured off, and the residue strongly squeezed. The united ingredients are then to be allowed to settle, and the decanted fluid boiled down to thirty ounces, and two ounces of Rectified Spirit added. The dose, fʒiv to f℥i.

SYRUP OF SARSAPARILLA, *Syrupus Sarzæ.* L. E.—*Syrupus Sarsaparillæ.* D.—Take of sliced Sarsaparilla ℥xv (℥xii, D.); boiling water *Cong.* i (old wine measure, D.); infuse the Sarsaparilla in the water for twenty-four hours, then boil down to Oiv; strain the liquor whilst it is hot; add the sugar, and evaporate to the consistence of a syrup. The dose is f℥i to f℥iii.

Dr. Hancock informs us that the following is the formula used at Angustura. Pour Cong. ii of water over lb. i of Rio-Negro Sarsaparilla, ℥ii each of rasped Guaiac-wood, Anise-seed, and bruised Liquorice-root, ℥i of the bark of the root of Mezereon, lb. i of Molasses, and six cloves; shake the vessel thrice a-day, and proceed to use the Infusion as soon as fermentation begins. The various additions to the Sarsaparilla in this preparation are not likely to augment the diuretic properties of the Sarsaparilla.

SENEGA, or SNAKE-ROOT*. *Senega.* L. E. D.—The plant † which yields this root is a native of North America and Canada, belonging to the natural order Polygalaceæ. It grows on the sides of hills and in dry woods, in Kentucky, Ohio, and Tenessee. The rhizome is irregularly shaped, and gives off two roots about the thickness of a quill, contorted, gibbous, and covered with a thick, dull, yellowish or greyish-brown bark: it has a peculiar

* It receives its name from having been long employed by the Senagaroo Indians as a remedy for the bite of the rattlesnake. It was applied externally, and internally administered.

† Woodville's Med. Bot. third edition, pl. 162, p. 452. London Dispensatory, art. Polygala. Barton's Vegetable Materia Medica of the United States, vol. ii, p. 111, pl. 36. Hayne, xiii, 21. Lindley, 125.

odour, which is lost in drying; its taste is bitter, pungent, and peculiar. The leaves are alternate, lanceolate; the flowers of this variety are white; but there is a variety with linear-lanceolate leaves, and pink flowers. The bark is the active part of the root: it yields its medicinal principle to boiling water, and still more completely to proof spirit. Water renders the tincture turbid; hence it might be suspected that the active principle is oleo-resin. M. Peschier has procured from it an alkaline principle, which he has named polygalin, and which he asserts exists in the Senega Root, in combination with a new acid which he has named *polygalinic*; it has also been analyzed by Feneulle, Dulong, and Tromsdorff; and more lately by Quevenue; but the opinions which have been advanced require confirmation by additional experiments.

Senega is a stimulating Diuretic; and its active principle, whatever it may be, is absorbed, and acts directly on the kidneys. On account of its influence on the vascular system, it cannot be administered in the first stages of inflammatory diseases.

Senega Root may be given either in substance, in the form of powder, infusion, or decoction.

INFUSION OF SENEGA. *Infusum Senegæ*. E.—Infuse for four hours, in a covered vessel, ʒx of Senega in Oi of boiling water, and strain. The dose is f℥ii to f℥iii.

DECOCTION OF SENEGA, *Decoctum Senegæ*, L. D. Boil ʒx (ʒiii, D.) of Senega, in Oii (Oiss, D.) of distilled water, down to Oi (f℥viii, D.), and strain. The dose is f℥ii to f℥iii.

The decoction is made with one ounce of the powdered root, and a pint and a half of water, boiled down to a pint; of which, from half a fluid ounce to a fluid ounce is a dose for an adult. The dose of the powder is from thirty grains to two scruples. It may be advantageously combined with mercurials.

Leaves.

PYROLA, WINTER GREEN*. *Chimaphila*. L. *Pyrola*. E. D. —This plant is a native of Europe, North America, and Northern Asia, belonging to the natural order Pyrolaceæ†. The plant rises, from a creeping rhizome, to little more than six inches in height. The leaves are lanceolate, somewhat wedge-shaped or narrowed towards the base, deeply serrated, of a coriaceous texture, and a glossy green colour. The flowers are white, dotted with red points, bell-shaped, and in a drooping umbelliferous cluster. The leaves, which are the parts employed, have a peculiar odour, and bitter and austere taste. According to the analysis of Dr. Wolf, they contain—18 parts of bitter extractive,

* Native American name, *Ipsissewa*.

† Barton's Vegetable Materia Medica of the United States, 4to. vol. i, p. 17, pl. 1. Richard, Hist. Nat. Med. t. ii, p. 169. Hayne, xiii. 13. Lindley, 375.

+ 20·4 of resin, + 1·38 of tannic acid, + 77·58 of woody fibre; but, as the extractive burns with a white flame and resinous odour, I am inclined to regard it as an oleo-resin. Both water and alcohol extract the active principle of the leaves. The decoction strikes a deep colour with sulphate of iron. The tincture is rendered scarcely turbid by water.

The diuretic properties of the Chimaphila *umbellata* were known to the Hourons and other Indians long before Europeans employed the plant. It was first used as a remedy in dropsy by Mr. Carter, surgeon to the hospital at Fort William, in Canada; and its influence was fully determined by Dr. William Somerville, who gave it a fair trial in the case of Sir James Craig, Governor of Canada, who was labouring under ascites, with a cachectic habit. Besides its diuretic influence, it operates as a tonic, increasing the powers of the stomach; and so far it has a decided advantage over many other Diuretics. The bruised leaves, applied to the skin, induce vesication and desquamation: I am therefore disposed to think that its diuretic properties depend on some acrid principle, which is separated in the stomach, and conveyed to the kidneys.

Chimaphila *umbellata* may be administered in the form of infusion, or decoction, or extract. The decoction is the best form of the medicine.

Decoction of Winter Green. *Decoctum Chimaphilæ*. L. *Decoctum Pyrolæ*. D.—Take ℥i of Chimaphila, and Oiss (Oii, old wine measure, D.) of distilled water. Boil down to Oi, and strain. The dose is f℥i to f℥iv. The dose of the extract, which is not officinal, is from ten to fifteen grains; and this may be repeated every third hour.

Tops of the Broom. *Scoparius*. L. *Scoparium*. E. *Spartium Scoparium*. D.—The Broom, *Cytisus scoparius*, is an indigenous shrub, a frequent inhabitant of our dry commons, belonging to the natural order Leguminosæ*. The plant generally rises to the height of five or six feet, branching towards the summit. The lower leaves are ternate, the leaflets obovate, obtuse; the upper, simple. The flowers are papilionaceous, with bell-shaped, bilabiate, gaping, purplish calyxes. The anthers are golden-yellow, the germen villous, and the style bent almost to a circle. The legume is compressed, brown, ciliated, and contains several flat, shining seeds.

The tops of the twigs are the parts of the plant employed. When boiled in water, a clear-brown decoction is obtained, which strikes a blackish or deep-olive tint with the solution of the persulphate of iron, and throws down precipitates with acetate of lead and nitrate of mercury. When the Broom tops are burnt,

* Woodville's Med. Bot. 3d edit. p. 413, pl. 150. London Dispensatory, art. Spartium. Hayne, ix, 10. Lindley, 239.

carbonate of potassa is procured from the ashes. These processes throw no light on the active principle of Broom. As a Diuretic, its tops have been used by the peasantry from time immemorial. It is probable that they undergo partial decomposition in the stomach. In large doses, they operate as an emetic or a cathartic. Broom tops are administered in the form of infusion, decoction, and extract.

INFUSION OF BROOM. *Infusum Scoparii.* L.—Digest ℥i of Broom tops in Oi of boiling distilled water for four hours, in a covered vessel, and strain. Dose, f℥ii to f℥iv, three times a day.

DECOCTION OF BROOM. *Decoctum Scoparii.* E.—Take of broom tops and Juniper tops, of each ℥ss, Bitartrate of Potassa ℥iii, water Oiss, boil them together down to Oi, then strain. Dose, f℥ii to f℥iv.

COMPOUND DECOCTION OF BROOM. *Decoctum Scoparii Compositum.* L.—Take of broom tops, Juniper berries, and Dandelion root, of each ℥ss, distilled water Oiss, boil down to Oi, and strain. Dose, f℥ii to f℥iv.

EXTRACT OF BROOM. *Spartii Extractum.* D.—To be prepared by the evaporation of a concentrated decoction. Dose, ℈i to ʒi. This is generally regarded as an inferior preparation.

* * *Inorganic Substances.*

l. ACIDS.

1. CARBONIC ACID. *Acidum Carbonicum.*—This acid is usually employed in solution in water, in combination with soda. It is procured by acting upon white marble with diluted Hydrochloric acid, in a tubulated bottle, and receiving the acid as it is extricated in a bottle containing a solution of Carbonate of Soda. This acid is a compound of 1 eq. of Carbon, + 2 eq. of Oxygen, making its equivalent = 22·12. It has a sp. gr. 1·5277; and 100 cubic inches weigh 47·3 grains. It is soluble in water, one volume of the fluid taking up one volume of the gas; it also readily combines with the alkalies and the alkaline earths. As a diuretic, it is used under the name of *Soda water*, in calculous affections and irritable states of the kidneys; but common Soda water contains very little soda. It is not easy to determine its diuretic influence; but it probably operates by giving tone to the stomach, whilst the alkali is conveyed to the kidneys.

2. TARTARIC ACID. *Acidum Tartaricum.* L. E. D. (p. 365). As a Diuretic, Tartaric Acid acts powerfully; but in what manner has not been determined. Its particular effects being the same as those of the bitartrate of potassa, they shall be noticed under the head of that salt.

3. CITRIC ACID. *Acidum Citricum.* L. E. D.—This acid (p. 362), exists ready formed, both in a free and a combined state, in many fruits and vegetable productions that display diuretic

properties. It has been detected in the Squill and the Onion, in combination with lime, and in the fruit of the Cranberry, Whortleberry, Hep, and most abundantly in the Lemon, in a free state. It possesses little power as a diuretic in its uncombined state. There is, nevertheless, sufficient reason for supposing that both it and Tartaric acid pass to the kidneys undecomposed; as they have been detected in the urine of those who have taken them freely. They augment the urinary secretion when they are administered to remove the tendency to the formation of the ammoniaco-phosphates: and when the kidneys are in such an irritable state as occasionally occurs in fevers and in the phlegmasiæ, they have been found useful. The ancients were well aware of their influence on the kidneys, and distinguished them from other Diuretics by the term *cold diuretics*, from an idea that their effects originated, not from any excitement on the kidneys, but, on the contrary, from a cooling or sedative influence on these organs. The dose is gr. x to gr. xv.

m. SALTS.

1. CARBONATE OF POTASSA. *Potassæ Carbonas.* L. *Potassæ Carbonas Purum.* E. *Potassæ Carbonas Tartari Crystallis.* D. —Carbonate of Potassa is procured by the combustion of land vegetables; and is prepared by merely dissolving the impure potash from these ashes in water, filtering, and evaporating the solution to dryness. It is sometimes, however, prepared by exposing the bicarbonate to a red heat; or the incineration of the Bitartrate of Potassa, as recommended by the Edinburgh and the Dublin Colleges; but this mode of obtaining it is unnecessary for medicinal purposes*. It is readily distinguished from the Bicarbonate, its solution precipitating Sulphate of Magnesia white, and bichloride of Mercury red-brown. Its purity is ascertained by its not precipitating Chloride of Barium, nor Carbonate of Soda, when formed into a nitrate; and scarcely with nitrate of silver. It is obtained in the state of a white, granular, opaque salt, deliquescent on exposure to the air, and dissolving entirely in the water which it attracts. Its water is expelled by heat, without decomposition of the salt. Its solubility in alcohol distinguishes it from simple Potassa. When pure, it consists of—potassa 61·57, + carbonic acid 31·43, = 100 parts; or, 1 eq. of potassa = 47·15, + 1 of carbonic acid = 22·12, equiv. = 69·15, ($C.\ O^2$, + $K.\ O$): but it contains, also, an indefinite proportion of water.

SOLUTION OF CARBONATE OF POTASSA. *Potassæ Carbonatis Liquor.* L. *Potassæ Carbonatis Aqua.* D.—Take of Carbonate

* The Carbonate of Potassa has, also, been prepared from Sal Enixum, Bisulphate of Potassa, by exposing it, mixed with charcoal, to a high temperature in a reverberatory furnace. A sulphuret is thus formed, which is decomposed by re-acting, and the sulphur being driven off, a carbonate remains.

of Potassa ℥xx (*one part*, D.), distilled water Oi (*two parts*, D.), dissolve and filter. The density of the Dublin solution should be 1·320. As a diuretic, it should be given at short intervals, in doses of f℥ss to f℥i. I have carried the dose up to f℥iii. In overdoses, it operates as a powerful irritant poison, its action being confined chiefly to the œsophagus, in which it causes stricture, and consequent starvation*. The best antidote is vinegar, and oily demulcents.

2. Bicarbonate of Potassa. *Potassæ Bicarbonas*. L. E. D. —If a stream of carbonic acid, extricated from white marble by means of hydrochloric acid, be passed through a solution of carbonate of Potassa until it is saturated, a bicarbonate is produced; or it may be formed by evaporating with a moderate heat, namely, 130°, a solution of sesqui-carbonate of ammonia and carbonate of potassa, until the pure ammonia is dissipated by the heat. This salt crystallizes in large tetrahedral, rhombic prisms, with dihedral summits; colourless, transparent, permanent in the air; of a mild, saline taste; and scarcely browning turmeric paper. It dissolves in four times its weight of water at 60°, and is decomposed when it dissolves in boiling water, which brings off one equivalent of the carbonic acid. It consists of—potassa 47·53, + carbonic acid 43·56, + water 8·91, = 100; or, 1 eq. of potassa = 47·15, + 2 of acid = 44·24, + 1 of water = 9, equiv. = 99·15. ($2\ C.\ O^2, + K.\ O, +$ Aq.)

Both of these salts, particularly the last, afford an agreeable mode of exhibiting Potassa as a Diuretic. The acid is partially separated in the stomach, and probably decomposed, while the alkali is carried forward to the kidneys, and acts there nearly in the same manner as pure potassa. The dose of the carbonate is from gr. x to ʒss, at first; but it may be augmented to ʒiii; that of the bicarbonate may be double the quantity of the carbonate. Both may be given in any bland liquid which does not contain lime or any substance capable of forming an insoluble compound with carbonic acid. The diuretic properties of these salts are not injured by administering them in a state of effervescence with lemon juice; the citric acid being separated by the digestive powers of the stomach in the same manner as the carbonic; and, if any febrile heat be present, this is the best mode of exhibiting them. The salt may be also administered in combination with an excess of Carbonic acid, as in the following preparation.

Effervescing Solution of Potassa. *Liquor Potassæ Effervescens*. L. *Potassæ Aqua Effervescens*. E.—Prepared by dissolving ʒi of Bicarbonate of Potassa in Oi of distilled water, and transmitting through the solution carbonic acid gas, until more has passed than suffices to saturate the solution. It should be preserved in well-stopped bottles.

* Bell's Surg. Observ. part i, p. 82.

This is more agreeable to the taste than the simple solution of the Bicarbonate. Dr. Pereira says it may be imitated by pouring a bottle of soda water into a tumbler containing gr. xx of Bicarbonate of Potassa*.

Effervescing Powders. *Pulveres Effervescentes.* E.—Take of Bicarbonate of Potassa one ounce and 160 grains, reduced to fine powder; Tartaric acid powder, one ounce; divide each into sixteen powders, in paper of different colours.

3. Acetate of Potassa. *Potassæ Acetas.* L.E.D. (p. 914).—As a Diuretic, Acetate of Potassa is undoubtedly decomposed in the stomach; and probably in this case the alkali only reaches the kidney. It has been given advantageously in hydropic diseases; but, frequently, it disappoints the practitioner: this sometimes, however, arises from its being overdosed; as, when it purges, it necessarily loses its diuretic powers. It may be administered in the infusion of gentian, or any light bitter, or in any bland demulcent fluid. It is better to give it in small doses, namely, gr. x to ℈i, frequently repeated, than in a full dose. I have seen it ordered, in cases of ascites, in conjunction with the bitartrate of potassa; but, for the reasons already stated, this combination purges, and counteracts the intention with which both salts are ordered.

4. Citrate of Potassa. *Potassæ Citras.*—This salt is generally prepared by adding a scruple of the carbonate of potassa to fifteen grains of citric acid in solution, or half a fluid ounce of recent lemon juice. It is seldom prescribed as a diuretic; but it is a useful vehicle for the administration of more powerful agents belonging to this order of medicines.

5. Bitartrate of Potassa. *Potassæ Bitartras.* L. E. D.—This salt (p. 912), when it is given in small doses, namely, from gr. x to ʒi, or more, operates as a powerful Diuretic. Its effects are explained by Dr. Paris, on the probability of the decomposition of the salt in transitu, and consequently the conveyance of the alkaline base to the kidneys. It is possible that this explanation may be correct; but when we consider that the quantity of alkali contained in a scruple of the Bitartrate is equal only to five grains, and that seven grains of the alkali are taken when twenty minims of the liquor potassæ are administered, yet, that the effects of the Bitartrate are much more considerable in producing diuresis than the liquor potassæ, there is some difficulty in assenting to the accuracy of this explanation. The influence of the Bitartrate in dropsical effusions is well authenticated; and, indeed, every day's experience confirms our confidence in its powers as a Diuretic. The emaciation which its continued use produces, when taken as a beverage, demonstrates the powerful effect of this salt upon the capillaries. It is frequently and beneficially combined with

* Elements of Mat. Med. p. 523.

squill, colchicum, and other diuretics; and, also, with infusion of gentian, and other bitter infusions. If the Bitartrate have weakened the digestive organs, which it occasionally does, it may be combined with tartarized iron. In cases which depend on hepatic or other glandular obstructions, Iodine, in the form of ointment, may be used at the same time; and in this form, the use of the Iodine may be continued with much advantage, when the internal use of it would have been injurious. The Bitartrate, in these cases, is administered in the usual doses, as if the Iodide were not employed. For diuretic purposes, the dose should never exceed ʒii: but it should be frequently repeated, until the kidneys be affected, diluting very freely during its employment.

The soluble Cream of Tartar, formed by the addition of biborate of soda to the Bitartrate, is said to operate also powerfully as a Diuretic. It requires only seven parts of water at 60° for its solution. It is not acted upon by boiling alcohol. The mineral acids decompose it very imperfectly. I have had no experience of its powers.

6. CARBONATE OF SODA. *Sodæ Carbonas. Sodæ Subcarbonas.* L. E. D.—The remarks made on the Carbonates of Potassa apply to those of Soda.

The Carbonate is found ready formed in the Salsola *Soda*, a plant growing abundantly on the shores of the Mediterranean; in the ice plant, Mesembryanthemum *crystallinum;* and in all the Fuci, from which it is obtained by simply burning the plants and lixiviating the ashes. All these plants seek the sea shore, or saline lakes, and require the soil in which they grow to contain common salt. It is also found native in the soil in India, Thibet, and several tropical countries; and in the Natron lakes of Hungary and Egypt. It also exists in several mineral-springs, as, for example, Vichy and Vals in France, and Bilin in Hungary. It is this salt which formed the nitron of the ancients. The best crude carbonate is BARILLA*, which is procured from the Salsola *Soda* and Salicornia *herbacea.* The Carbonate, for medicinal use, is ordered to be procured by boiling the *Barilla* in water, filtering, and evaporating to obtain crystals, which are Carbonate of Soda. The mother water retains the salts with which it is combined in the Barilla. The French chemists properly remark, that when barilla is employed to yield Carbonate of Soda, it is preferable to lixiviate with cold water, as the boiling water takes up many of the other salts contained in the barilla. The greatest part of the Carbonate of Soda used in this country is now obtained from the decomposition of Sulphate of Soda, prepared

* Sodæ carbonas impura. L. Sodæ carbonas venale sive Barilla. D.

from Chlorate of Sodium; and a purer salt is obtained by this method than can be usually procured from the barilla*.

Carbonate of Soda, when pure, is in large, beautiful, octohedral crystals, colourless, nearly transparent, with a rhombic base, the acute angles of which are generally truncated. The taste of this salt is acrid, urinous, and disagreeable: it is inodorous, and displays an alkaline reaction on the solution of rhubarb, and on turmeric paper. It is soluble in two parts of water at 60°, and in less than its own weight of water at 212°. It crystallizes on cooling. It effloresces on exposure to the air. The chemical constituents of Carbonate of Soda are—

Soda.............	22·25	1 eq. =	31·3
Carbonic Acid.	15·25	1 — =	22·12
Water...........	62·5	10 — =	90·0
	100·00	Equiv. =	143·42

It often contains Sulphate of Soda and common salt mixed with it: but by forming the salt into a nitrate and adding nitrate of silver, the common salt is detected; whilst nitrate of baryta detects the Sulphate of Soda. Carbonate of Soda is much less powerful than the Carbonate of Potassa; although it passes off by the kidney, and can be detected in the urine. The dose of this salt is from gr. xv to ʒii, in any vehicle not containing acidulous salts, lime water, hydrochlorate of ammonia, or solutions of earthy and metallic salts.

Dried Carbonate of Soda. *Sodæ Carbonas exsiccata.* L. *Sodæ Carbonas siccatum.* E.—Expose to heat any quantity of Carbonate of Soda, in a proper vessel, until it is dry, then heat it to redness. The dose is gr. x to ℈i.

Solution of Carbonate of Soda. *Sodæ Carbonatis Aqua.* D.—Dissolve ℥i of Carbonate of Soda in lb. i of distilled water, to make a solution of the density 1024. The dose is fʒi to fʒii, in any bland liquid.

7. Sesquicarbonate of Soda. *Sodæ Sesquicarbonas.* L. Bicarbonate of Soda. *Sodæ Bicarbonas.* E. D. — A salt is found in a state of nature in the province of Sukena, in Africa, where it is called trona: it is a sesquicarbonate of Soda. It is artificially prepared by passing through the solution of the carbonate a stream of carbonic acid gas. In its pure state it consists of—

* To procure it from Sulphate of Soda, 100 parts of this salt are mixed with 120 of carbonate of lime and powdered pit-coal; this mixture is then exposed to the heat of a reverberatory furnace, until flames cease to be emitted and a pasty mass remain. The sulphuric acid is decomposed and its sulphur partly united with the lime, partly dissipated in the form of sulphurous acid, while the carbonic acid combines with the Soda The Carbonate of Soda is then obtained by lixiviation and crystallization.

Soda	38·55	1 eq.	=	31·3
Acid	39·76	½ —	=	33·62
Water	18.00	2 —	=	18·00
	100·00			Equiv. 82.62

The salt, denominated Bicarbonate by the Edinburgh and Dublin Colleges, is the same as the Sesquicarbonate of the London College.

The pure salt is in crystalline grains, which are oblique rectangular prisms*. In general, however, it appears as an opaque, white powder, or in irregular, small masses. It dissolves in 13 parts of water at 60°, and in boiling water it loses one fourth of its acid and becomes the carbonate. It is, sometimes, adulterated with Carbonate of Potassa, which, however, is readily detected by combining it with an excess of tartaric acid, which throws down the bitartrate of potassa, if the carbonate of that alkali be present. A solution of forty parts of water does not give an orange precipitate with bichloride of mercury. The taste of the salt is scarcely alkaline; and, therefore, it can be taken with less disgust than the carbonate; and it is more generally employed as a Diuretic.

Both the carbonate and this salt are given as Diuretics in dropsical affections, in which deposites of lithic or rosacic acids are found in the urine. They are decomposed in the stomach, and the soda only is conveyed to the kidneys: they possess, therefore, no advantage over the pure alkalies, except in point of taste and greater mildness of operation. The tonic power of the carbonic acid, which is extricated in the stomach, prevents any unpleasant effect from the alkalies, even in the most irritable habits†. The dose of the Bicarbonate is from gr. x to ʒi. It is decomposed by the same substance as the Carbonate.

Effervescing Solution of Soda. *Liquor Sodæ effervescens.* L. *Sodæ Aqua efferrescens.* E. *Aquæ Carbonatis Sodæ acidula.* D.—Dissolve ℥i of Sesquicarbonate (Carbonate, D.) of Soda in Oi of distilled water, and pass through the solution, under pressure, more carbonic acid than is sufficient for saturation. Keep the solution in a well-stopped vessel. This is an agreeable and useful mode of administering Bicarbonate of Soda as a diuretic, when there are lithates present in the urine; but nothing is

* Chem. of Inorganic Bodies, vol. ii, p. 54.

† M. D'Arcet remarks, that, in the French manufactories of Carbonate of Soda, the workmen who are pounding, sifting, and barrelling the salt, respire and receive also into the stomach a large quantity of the salt which is constantly floating in the air, and that their clothes are always impregnated with it: yet these workmen enjoy good health, have no complaint but that of hunger, and are slightly constipated. He calculates that each workman swallows at least ten grammes of the salt per day.—*Ann. de Chimie, et Phys* x. xxi, p. 66.

more deleterious if the urinary deposites are phosphates*. This solution may be made at once by pouring a bottle of soda water in ℥ss of Sesquicarbonate of Soda.

Effervescing Powders, *Pulveres effervescentes*, E. are made in the manner already detailed under the head of Bicarbonate of Potassa, employing ℥i grs. 54, and ℥i of Tartaric acid, for making the sixteen powders. The addition of fℨi of any aromatic tincture, or of any pleasant syrup, to the solution of the acid, renders these powders a very agreeable beverage.

8. Biborate of Soda. *Sodæ Biboras*. L. Borate of Soda. *Borax*, E. D. — This salt (p. 372) is seldom employed as a Diuretic in this country. It, nevertheless, possesses diuretic powers. It has been detected in the urine, unchanged, by Wohler. I have administered it successfully in cases of ascites, in which the uric acid has abounded in the urine. It may be given in doses of ℨss to ℨi dissolved in almond emulsion or any bland fluid.

B. INDIRECT DIURETICS.

This division of Diuretics contain substances which act primarily on the nervous system, and secondarily on the capillary system, particularly the kidneys. These agents are of two distinct kinds: the one set diminishing arterial action, and throwing a large supply of fluids upon the circulating mass; the other set increasing the general tone of the habit, in which case the kidneys share in the benefit.

1.—DIMINISHING ARTERIAL ACTION.

* *Organic Products.*

n. Tobacco (p. 308). — The influence of Tobacco in diminishing arterial action, whether taken into the stomach, applied to the surface, or injected into the rectum, would lead us to regard it as a remedy of great power as a Diuretic; and if it could be managed so as to control the circulation, there is no doubt that, in the direct ratio of its influence in this respect, although its influence on the absorbents is problematical, yet we should find it, by increasing diuresis, prove a most useful remedy in dropsical accumulations; but its unmanageable character has hitherto prevented it from being much employed as a Diuretic. No medicine requires so much caution in its administration under the most favourable circumstances; and, therefore, it has yielded place to other sedative Diuretics. It was first recommended by Dr. Fowler, who published an account of several cases of ascites and anasarca treated with it†. For diuretic purposes, any of the kinds of Tobacco may be employed, as they all contain Nicotina. This

* Prout on Affections of the Urinary Organs, second edition, p. 145.
† Medical Report on the Effects of Tobacco, 1785.

substance is supposed to be the active principle of Tobacco; but whether it excites the same stimulant action on the mucous membrane of the intestines as on that of the nostrils, it is difficult to demonstrate, although there is every reason to suppose that it does so; and probably, therefore, we may consider that Nicotina is the purgative principle of tobacco; but the sedative and antispasmodic properties of tobacco are undoubtedly due to its volatile oil; and it is the influence of this on the nervous system which produces the powerful sedative effect of tobacco when it is applied to an external surface. It nevertheless is contended that this volatile oil is not a direct sedative, but operates in the first instance as an excitant. Thus we are informed by M. Nick, of Tubingen, that smoking a pipe of Tobacco in the morning, even by those accustomed to its use, accelerates the pulse from fifteen to twenty beats in the minute, and this continues for an hour afterwards. Too little is known of the therapeutical qualities of Nicotina to allow us to say how much of the influence of Tobacco is due to it. In small doses, Nicotina causes vertigo in quadrupeds.

Tobacco, when administered, either in the form of infusion or of wine, in doses so small as not to nauseate, has proved useful in dropsy. Tobacco has been, perhaps, less prescribed as a Diuretic than it deserves to be. It is chiefly prescribed in the form of wine.

Wine of Tobacco. *Vinum Tabaci.* E.—Digest ℥iiiss of Tobacco in Oii of Sherry for seven days, express strongly the residue, and filter the liquor. Dose, from m. x to m. l.

o. Foxglove, leaves and seeds. *Digitalis folia semina,* L. *Digitalis folia,* E. D.—The diuretic powers of the leaves of Foxglove, Digitalis *purpurea* (p. 457), are supposed to depend on Digitalia, an alkaloid obtained from the leaves of the plant, in minute, colourless, acrid crystals, of an undetermined form, and persistent in the air. It displays an alkaline reaction, is soluble in alcohol, and combines with weak acids: concentrated sulphuric acid, however, first reddens and then changes it to an olive green colour. The alcoholic solution is decomposed by water, infusion of galls, and diacetate of lead. The efficacy of Foxglove, as a Diuretic, is modified by the period of the growth of the plant at which the leaves are collected, and the manner of drying and preserving them. They are in the best state in the second year's growth of the plant, in the months of July and August; at which time they should be gathered and dried between colourless bibulous paper, in a warm room, under moderate pressure. When the dried pulverized leaves lose their green colour, some chemical change takes place in them, which diminishes their activity; and, consequently, they should never be employed in this state.

As far as respects the diuretic powers of the Foxglove, it

should be recollected that they are not obtained in that condition of the habit which exceeds the limit of healthful tone; for no benefit can be expected from its employment as long as any tension of the vascular system exists. It is only after ample depletion, or at least such as reduces greatly the frequency of the pulse, that it affects the capillary system and augments the urinary discharge: or, after tapping and a reduction of arterial action, that decisive advantages are obtained from the employment of Foxglove in hydropic affections.

In looking into the history of Foxglove, we find it in the London Pharmacopœia, in the beginning of the eighteenth century, although it was omitted in 1746, and was not reinstated until 1788, ten years after its practical restitution as a Diuretic by Dr. Withering, who brought it before the profession in 1775. In consonance with the opinion which I mentioned, respecting the diuretic influence of Foxglove, Dr. Withering and those who have followed him, found it most useful in lax, pale, leucophlegmatic habits; and if the disease be anasarca, in those cases in which pitting is left on pressure of the affected parts: hence, when this state does not exist, the system must be lowered by blood-letting and purging, before any advantage can be expected from Foxglove as a Diuretic. It has been found most beneficial in hydrothorax, and, next to that, in anasarca. In cases of dropsy, also, following scarlatina, it has been found very useful, after purgatives have been freely employed; and in those instances of anasarca, and occasionally of ascites, which attack constitutions broken down by long and severe courses of mercury. The best adjuncts to Foxglove, in those cases, are calomel, bitartrate of potassa, acetate of ammonia, and colchicum; and, in broken-down constitutions, it is beneficially conjoined with nitric acid; and the Tincture of the Sesquichloride of Iron; the solution of the Potassio-tartrate of Iron. It may be given either in the form of powder, or infusion, or tincture. If administered in the form of powder, it is frequently combined with calomel and squill; but these adjuncts are supposed by Dr. Blackhall not to be very admissible. He remarks, "the practice is unsafe and not very consistent:" indeed, he regards the depressing effect of Digitalis to be at variance with the stimulant effect of the calomel; and adds, "where the urine is coagulable, and Digitalis agrees, both calomel and squill are positively injurious. On the contrary, where the urine is foul and not coagulable, and squill with calomel renders service, I have on that very account made less trial of Digitalis, and cannot therefore speak of it from experience." My experience does not accord with Dr. Blackhall's views: I have found that Foxglove acts as an excitant on the capillary system.

The dose of the powder should be gr. i, repeated once in eight hours; but when its effects display themselves, it should

not be repeated oftener than once in twelve hours; then, once only in twenty-four hours; and, ultimately, once in forty-eight hours, to prevent its accumulation in the system. The following preparations may be used as Diuretics.

INFUSION OF FOXGLOVE. *Infusum Digitalis.* L. E. D.—Take of dried Foxglove leaves ʒi (ʒii, E.); Spirit of Cinnamon, f℥i (f℥ii, E. ℥ss, D.); boiling distilled water Oi (f℥xviii, E. f℥viii, D.); macerate the leaves in the water for four hours, in a lightly covered vessel, then strain, and add the Spirit of Cinnamon. This form of infusion speedily produces the diuretic effects of the plant: but much of the efficacy of both the powder and the infusion depends on the manner in which the leaves have been preserved. The dose is f℥ss to f℥i, repeated every sixth hour.

TINCTURE OF FOXGLOVE. *Tinctura Digitalis.* L. E. D.—Macerate ℥iv (ʒii, D.) of dried powdered Foxglove leaves in Oiii (f℥xvi, D.) of proof spirit, for fourteen days (seven, D.) and strain. It is best prepared with newly dried leaves, by percolation. When first prepared, it is of a beautiful olive-green colour; but it gradually becomes of a brown-green, when kept*. The tincture is a very excellent preparation, as it can always be made when the leaves are in the best condition. The dose of the tincture, m. x to m. xx at first, once in six hours; but this dose, in many cases, may be gradually augmented to m. lx, and even to m. lxx, three times a day.

EXTRACT OF FOXGLOVE. *Extractum Digitalis.* L. E.—Bruise fresh-gathered Foxglove leaves, sprinkled with a little water in a stone mortar, then press out the juice and evaporate it to a proper consistence.

The Extract is valuable when well prepared, which is a difficult task to perform.

The dose is gr. i once in eight hours. Much caution is requisite in augmenting the dose.

PILLS OF FOXGLOVE AND SQUILL, *Pilulæ Digitalis et Scillæ,* E. is made by beating together into a proper mass, with Confection of Red Roses, *one part* of Digitalis, *one part* of Squill, and two parts of Aromatic Electuary; and dividing the mass into four-grain pills. It is a valuable diuretie, when administered in doses of one or two pills.

When an overdose of Foxglove is taken—for I know of no instance in which it has been used as a poison, with the view of committing murder or suieide—the symptoms are nausea, vomiting, vertigo, pulsation in the temples, a sense of heat throughout the body; oeeasionally diarrhœa; sometimes, but

* Mr. Squire, of Oxford-street, has for some years past prepared an expressed juice from the recent leaves, which keeps well, when f℥iv of spirit, 56 over proof, is added to f℥xvi of the juice. I have given it in the same doses as the tincture.

rarely, salivation; and, for the most part, profuse sweating. In a few instances the result has been fatal. One symptom recorded in some of the cases is remarkable—a suppression of urine. Post-mortem examinations of the body have displayed the brain much injected with blood, and the villous coat of the stomach displaying redness in some parts. When poisoning by Foxglove has taken place, the best remedial agents are ammonia, brandy and water, and opium: and the stimulus of a blister to the region of the stomach, which rouses the nervous energy and gradually restores the functions of the sensorium. One circumstance connected with its poisonous influence should be more generally known than it is—I refer to the singular fact of the medicine accumulating in the habit like mercury, and bursting forth with violence when not expected. At all times, when nausea comes on, the dose should be diminished; and we must recollect that vomiting instantly arrests the diuretic influence of Foxglove.

LACTUCARIUM. *Extract of Lettuce. Lactucarium.* L. E. —This is the inspissated juice of the Lactuca *sativa* and L. *virosa**, plants belonging to the natural order Compositæ (p. 465). This inspissated juice of the garden lettuce was introduced into practice as a narcotic by the father of the late Dr. Duncan†. He imposed upon it the name of *Lactucarium*. It may be collected in various ways; the best method is to make transverse incisions in the shoots of the plants when they are in flower, and to scrape off the exuded juice. The relative quantity yielded by one plant of the garden lettuce and one of the Lactuca *virosa*, is in the proportion of seventeen grains of dry Lactucarium from the garden lettuce, and fifty-six from the Lactuca *virosa*. Besides this method for procuring the juice, the following is also used:—the plant is to be broken into small lengths, without employing a knife, except in the tougher parts of the stem, which contain little proper juice; then the whole is to be submitted to the press, and the expressed juice inspissated with a moderate degree of heat. It is this preparation which is used under the name of *Extract of Lettuce* as a Diuretic, in doses of from five grains to ʒi or more, gradually augmented. It is seldom prescribed in England: but it has been found useful, in cases of hydrothorax, by the German physicians. It is, however, a better narcotic than a diuretic.

From the similarity of the taste and odour of the proper juice of the strong-scented lottuce to those of opium, the active principle has been supposed to be morphia; but this alkaloid, if present, cannot be separated from it, and there is, at least, no

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* Woodville's Med. Bot. third edit. p. 75, pl. 31. London Dispensatory, art. L. sativa Lactuca. Richard, Hist. Nat. Med. tome ii, page 351. Hayne, vii, 30, Lactuca virosa. Hayne, i, 47. Lindley, 469.

† Observations on Pulmonary Consumption, 1813.

meconic acid present in Lactucarium. The Edinburgh College orders a Tincture and Lozenges of Lactucarium.

TINCTURE OF LACTUCARIUM, *Tincturæ Lactucarii*, E. is made with ℥iv of Lactucarium, in fine powder, and Oii of Proof Spirit, by percolation. Each drachm of the Tincture contains six grains of Lactucarium. The dose is from m. xx to f℥i.

LOZENGES OF LACTUCARIUM, *Trochisi Lactucarii*, E. are made in the same manner and with the same proportions of materials as Opium lozenges. Each lozenge should weigh gr. x, and contain one-sixth of a grain of Lactucarium.

* *Inorganic Substances.*

q. TINCTURE OF SESQUICHLORIDE OF IRON. *Tinctura Ferri Sesquichloridi.* L. *Tinctura Ferri Muriatis.* E. *Muriatis Ferri Liquor.* D.—This is an etherial solution of the Sesquichloride of iron, containing some *rectified spirit* and *hydrochloric acid,* with a small portion of *protochloride of iron.* It is not, assuredly, a Diuretic, in the strict meaning of the term, as it does not operate directly on the urinary secretion, but merely on the bladder of urine, when that is affected by spasm. Its diuretic powers are indirectly exerted. It should not be administered in any solution containing gum acacia, as that decomposes it. The dose is m. x, gradually augmented until the desired effect is produced.

Some excitants are also beneficially administered as Diuretics, when no inflammatory symptoms exist to contraindicate their employment. They are chiefly combinations of alcohol and volatile oil; such, for example, as are found in hollands, common gin, and whiskey. The following combination of nitric ether and alcohol is still more commonly employed:

SPIRIT OF NITRIC ETHER. *Sweet Spirit of Nitre. Spiritis Etheris Nitrici.* L. E. *Spiritus Ætherius Nitrosus.* D.—This compound is formed in a different manner by each of the British Colleges.

The *London College* orders f℥iv of Nitric Acid to be gradually added to lb. iii of rectified spirit, and f℥xxxii distilled off from the mixture.

The *Edinburgh College* orders it to be made with hyponitrous acid, prepared in the following manner, and rectified spirit: "Put f℥xv of rectified spirit, with a little clean sand into a mattrass, fitted with a cork, through which are passed a safety tube, terminating an inch above the spirit, and another tube leading to a refrigeratory. The safety tube being filled with pure nitric acid, add through it ℥iiiss of the pure nitric acid, (density 1500). When the ebullition, which slowly rises, is nearly over, add f℥iiiss more of the acid gradually, f℥ss at a time, waiting till the ebullition caused by each portion is nearly over before adding more, and cooling the refri-

geratory with a stream of water, iced in summer. The ether thus distilled is to be agitated first with a little milk of lime, till it ceases to redden litmus paper, and then with half its volume of concentrated solution of muriate of lime. This pure hyponitrous ether, which should have a density of 899, is then to be mixed with f℥xxi of rectified spirit."

The *Dublin College* directs us to "add to the matter remaining after the distillation of nitrous ether, the rectified spirit employed in the operation for condensing the elastic vapour, and distil, till the residue be dry, with the greater heat of a sand bath. Mix the distilled liquor with the alkaline liquor remaining after the separation of the nitrous ether, and add as much well-dried Carbonate of Potassa as shall be sufficient to saturate the predominant acid, as tested by litmus. Finally, distil, as long as any drops come over, by the medium heat of a water bath. The sp. gr. of this liquor should be 850.

In these processes the nitric acid yields up its oxygen to the hydrogen and carbon of the *ethule*, one of the components of the alcohol; two equivalents of water is thus formed; one eq. of hyponitrous ether* combined with one eq. of water, and one eq. of aldehyd. The hyponitrous ether, distilled with the rectified spirit, constitutes the *Sweet Spirit of Nitre*, or *Spirit of Nitric Ether*.

This spirit is colourless, limpid, with a fragrant, etherial odour, and a pungent, slightly sweetish, acidulous taste. The specific gravity of the London preparation is 0·834; that of the Edinburgh, 847; of the Dublin, 850. It is very volatile, but is less inflammable and volatile than sulphuric ether. When recently made and mixed with tincture of guaiacum, it strikes a deep blue colour, owing to some uncombined nitrous acid contained in it. When it has been kept long enough to assimilate this acid, no such effect is produced. It is incompatible with solution of protosulphate of iron and the alkalies. The dose is from f℥ss to f℥iii, in any bland vehicle; and in this form it is a very *generally* employed Diuretic.

Besides the Diuretics which are of a material nature, the urinary secretion is powerfully influenced by the passions of the mind. Fear is one of the passions which operate powerfully on the urinary organs: the secreting and excreting vessels lose their contractile force, and hence a great flow of urine occurs. Sweat-drops appear on the forehead, and a diabetes or a diarrhœa often follows. The urine voided under such circumstances is pale; the desire of passing it frequent; and the sphincter of the bladder is affected. But the physician cannot take advantage of this mental affection in the treatment of disease.

* This ether is a compound of 4 eq. of Carbon = 24·48, + 5 Hydrogen = 5, + 4 Oxygen = 32, + 1 Nitrogen = 41·15, eq. 75·63.

2. DIURETICS WHICH OPERATE BY AUGMENTING THE TONE OF THE HABIT.

The Diuretics under this division consist of tonics and excitants: they operate by producing a secondary effect on the kidneys.

The influence of tonic substances, as Indirect Diuretics, is most felt in those diseases in which the powers of the system are greatly lowered, and there is a consequent accumulation of fluid in the serous cavities and the cellular tissue; as, for example, in asthenic ascites, which sometimes follows acute diseases. In these cases, however, although the bitter vegetable tonics will do much, yet even the tone which they produce is hurtful, unless the secreting organs be stimulated to more healthy action; purgatives, therefore, ought to precede their use, and mercurials be employed at the same time. In such cases, also, much benefit is derived from the Potassio-tartrate of Iron, which, besides operating as a tonic, exerts also a diuretic influence; and it has been found peculiarly serviceable in anasarca connected with affections of the heart; but, in these cases, its employment should be preceded by purgatives.

3. INDIRECT SUBSTANCES WHICH OPERATE PRIMARILY ON THE CAPILLARIES.

These are chiefly Mercurials. Much benefit is derived from their aid in promoting the operation of other Diuretics; for they are seldom used alone as Diuretics. Thus, the diuretic influence of Squill, Colchicum, and Digitalis, is rendered more certain by being combined with Calomel or the blue pill. The mercury stimulates the capillary system, and in this manner, independent of any increased action of the absorbents, it aids the influence of the active principles of other Diuretics on the kidneys.

THERAPEUTICAL EMPLOYMENT OF DIURETICS.

After the view which has been taken of the substances most commonly employed as Diuretics, their practical utility as remedial agents may be briefly stated. The character of many of them as stimulants operating on the kidneys, points out the propriety of not employing them in cases of inflammation of these organs. The range of diseases for which they are adapted is undoubtedly very limited.

With regard to their influence in *febrile* affections, much must be done before prescribing them; but, in long-protracted fever, whether intermittent or continued, accompanied with œdematous swellings, their use is indicated, and must not be delayed. If they be prescribed during fever, it must be recollected that one of the most distressing symptoms in that disease

is retention of urine; and therefore, in prescribing Diuretics, it is highly requisite to examine daily the state of the bladder. Most fevers in their termination display critical changes either in the quantity or the quality of the urinary discharges; and therefore, under such circumstances, it becomes a question how far a Diuretic is likely to favour such a crisis. At the commencement of fevers, the urine is generally pale; it becomes afterwards high-coloured; and, at the termination of a paroxysm, if the fever be intermittent or remittent; or, when it begins to decline, if it be of a continued type; a sediment, either of a brick-red colour, *lateritious* as it is termed, or of a *pale pink colour*, is deposited, and has been regarded as critical: but this sediment is to be viewed rather as the result of a certain catenation of actions, than as the excretion of any thing injurious to the habit; and, were Diuretics able to promote it, they would be of no avail. Upon the whole, therefore, even as simple evacuants, Diuretics are of little value, either in idiopathic fever or in acute diseases, where fever is a symptom.

Whatever may have been the primary disease, the appearance of Dropsy indicates the necessity for Diuretics.

Dropsy, whatever form it assumes, is a morbid deposition of fluids, generally into the serous cavities and the cellular tissue. It is most common in the peritoneal sac, and the general cellular tissue; less common in the pleura; and still less so in the pericardium, and the cerebral cavities. It is generally a secondary process; the result of a peculiar condition of the minute or capillary arteries, furnishing blood to the tissue which is the seat of the exhalation. In the distended state of the capillaries which exists during inflammation, a great and disproportionate augmentation in the exhaled fluid takes place: we find this effused into the filamentous tissue in œdema and anasarca. In the serous membranes, one of the first effects of inflammation, under certain circumstances, is a more or less copious effusion of fluid, containing various proportions of coagulable lymph. Again, the capillary distension which occurs in fever is not an unfrequent cause of profuse exhalation: a fact demonstrated by the collections of limpid serum often present in the brain and the spinal chord, and occasionally in the pericardium; as well as by the brownish serum often collected in the pleural sac, in the bodies of persons who have died of fever.

That mere impediments to the return of venous blood will cause morbid effusions, is well known; and has been also supposed to be readily demonstrated by experiment. Thus, Lower, having tied the vena cava of a dog, produced dropsy in a few hours: but, in this case, it is probable that the effusion was the consequence of the *inflammation* of the peritoneum set up by the experiment. The fact, however, of obstructions, such as I have alluded to, is sufficiently established

by the effects of deranged circulation, as they occur either in veins, or in arteries, or in the capillary system. Whichever of these causes may have produced dropsical effusion, its removal is to be effected either by the aid of diuretics after the inflammatory action is completely subdued, or by stimulating powerfully the intestinal exhalants by hydrogogue purgatives. Diuretics stimulate the capillaries, so that, any fresh effusion being prevented, the absorbents are enabled to take up the fluids already effused, and to throw them upon the kidneys, as their natural emunctories, without any increase of their normal function.

Digitalis is usually regarded as the most important Diuretic in general dropsy. I have already pointed out that it is not, strictly speaking, a direct Diuretic: I have also spoken of its primary stimulant property, and stated that no benefit can be expected from its employment as long as any tension of the vascular system exists. It is after tapping, and the reduction of arterial action, that its salutary influence is displayed in general dropsy. If the remedy be administered in powder, gr. i may be given at intervals of six or eight hours; after which, the intervals should be extended according to the effects produced. If an infusion be preferred, it operates most beneficially when it is made with ℨi of the dried leaves and f℥xii of boiling water, and given in doses of f℥i at intervals of five hours: if it be thought advisable to give the Tincture, which undoubtedly is the best preparation, it may be administered in doses of ten minims at first, and afterwards gradually increased until its diuretic influence be obvious. No medicine, however, requires to be more closely watched than Digitalis, whether it be administered in moderate doses long continued, or in gradually augmented doses. Whenever nausea is felt, it must be *noticed,* and suppressed by the suspension of the medicine; and it ought always to be borne in memory, that *vomiting arrests diuresis.*

Squill, although a less powerful diuretic than digitalis, operates more efficiently in dropsy, when it is combined with neutral salts; or small proportions of blue pill, sufficient only to effect the gums slightly. We have the authority of Dr. Blackhall, that this combination is much to be depended upon, when, along with oppression of the chest, the urine is scanty, high-coloured, and without albumen. I have found ample grounds for being satisfied with the diuretic powers of the Chimaphylla *umbellata,* in every case where the dropsy is co-existent with a *broken-down frame* of body. It is best prescribed in form of decoction, made with an ounce of the dried plant, macerated in two pints of cold water, and then boiled down to one pint. In doses of f℥ii, this quantity should be consumed in the course of twenty-four hours. Occasionally it purges; and, as the habit readily gets accustomed to its stimulus, it is better to omit the medicine occasionally for a short time, and to resume it afresh,

than to continue it until the system has become insensible to its influence.

I have already made a few remarks on the diuretic powers of Colchicum, when administered in conjunction with Mercurials. It is said to be peculiarly beneficial in dropsy connected with a diseased condition of the liver; and it has succeeded in stimulating the kidneys when no other remedy has had any effect. The Compound Tincture of Colchicum of the London College, which is made with the aromatic Spirit of Ammonia and the seeds of Colchicum, is generally that employed in this form of dropsy. It may be administered in doses of f℥ss to f℥i three times a day, in conjunction with a few grains of blue pill night and morning. When the dose is carried beyond f℥i of the Spirit, it is very apt to induce hypercatharsis, and symptoms closely resembling those of Cholera. In the same form of dropsy, Tobacco was proposed by Dr. Fowler: and it is undoubtedly a most powerful Diuretic, but one which demands more caution in the prescriber than even digitalis. The form prescribed by Dr. Fowler was an ounce of Tobacco, in its dried state, macerated for an hour in a pint of boiling water, and then evaporated to fourteen fluid ounces, which were strained off, and f℥ii of Rectified Spirit added*. Thirty minims of this infusion were given, at first, three times a day, and the dose gradually increased, until the flow of urine was augmented, or until sickness or vertigo supervened. Dr. Fowler has carried the dose to one hundred and eighty drops at night, and one hundred in the morning. In five of the cases which are reported as having been successfully treated by this medicine, the disease was the sequel of ague, with enlargement of the spleen. I have had no experience of the influence of Tobacco, which is a more direct sedative than most other Diuretics, and consequently may be given during the existence of inflammatory action.

In Ascites, much depends on a knowledge of the origin of the disease. Depletion, in general, may be carried farther in this than in the other forms of dropsy; and, until tension is reduced by depletion, Diuretics are of little avail. In exciting the urinary organs, mercurials are much relied upon, in combination with direct Diuretics, especially Squill. As a general fact, indeed, it may be stated that, not only in Ascites, but in every form of dropsy, Diuretics have their influence much increased by the addition of mercurials; and it is often necessary to change the Diuretic, in order to keep up the action which has been begun in the kidneys. It must be admitted that Diuretics often fail in Ascites: but, as it is not the object of this work to detail the general mode of curing any disease, beyond the aid which is

* The wine of Tobacco of the Edinburgh Pharmacopœia is intended as a substitute for Fowler's solution.

required from the Class of remedial agents under review, I shall not therefore make any remarks upon the value of other remedies which do not exert a diuretic influence. In *Hydrothorax*, Diuretics are the remedies most to be relied upon; and, of these, Foxglove is superior to all the others, when administered with the precautions to which I have already referred. But, after all, Hydrothorax, like every other form of Dropsy, is almost always a symptomatic affection; hence its cure must depend, in a great measure, on the treatment of the original disease.

In *Hydrocephalus*, we are constrained to admit that Diuretics are either of no value, or that they are of doubtful efficacy. Digitalis was first used by Dr. Withering, who gave it early in the disease, during the height of the inflammatory action, under the mistaken idea of its direct sedative powers to reduce excitement; and, in the latter stage, to favour the absorption of the effused fluid. There is, however, no form of dropsical effusion in which the influence of Foxglove is so difficult to be ascertained as Hydrocephalus. At that period, when it is most likely to prove beneficial, namely, the latter stage of the disease, the irregular state of the pulse, the great tendency to vomiting, and the derangement of the cerebral functions which belong to the disease, prevent us from recognizing the effects of the remedy. The dose, at first, should not exceed ten minims; but it may be increased two or three minims once in every four hours. Dr. Cheyne carried the dose to 120 minims in a day, when the patient was a child only four years old. He points out the following as the data by which we can recognize the effects of the remedy amidst the symptoms of the disease. 1. From Foxglove, after a time, the pulse is *slow, irregular, small* and *sharp*; in the disease, it is *full* and *soft*: 2. the *languor* from Digitalis is attended with *vertigo*, and occasionally with *momentary blindness;* that from Hydrocepalus is generally accompanied with *Coma*. But, upon the whole, neither Foxglove nor any other Diuretic seems to be worthy of much confidence being reposed in it in this intractable disease. And, indeed, we may conclude our remarks on this Class of Medicines by saying that little advantage can be anticipated from it in those Dropsies which originate from organic affections; and still less in encysted Dropsies. There are exceptions, however, to this remark; and we find some serious accumulations, of an encysted character, yielding to diuretics:—thus, cases of dropsy of the Amnion, or as it is termed Hydrometra *gravidarum*, has yielded to Squill and Bitartrate of Potassa, aided by the pressure of a roller over the abdomen. It is chiefly, however, in the dropsical effusions which are connected with debility and deranged conditions of the Capillary system, that Diuretics can be relied upon as certain remedial agents.

SECTION XVII.

EMMENAGOGUES*.—MEDICAMENTA EMMENAGOGA.

These are medicines which are supposed to promote the menstrual discharge, when it is suspended or defective in quantity. In has been doubted whether any medicines act directly upon the uterus; the apparent agency of some in promoting its periodical discharge being referred to their influence in producing a condition of the system favourable to health, and the uterus sharing in the salutary effect. To determine the correctness of this opinion, we must *first* take into consideration the nature of the uterus in the unimpregnated state; *secondly*, the character and causes of its periodical discharge; and, *lastly*, whether the organ can be directly acted upon by any medicines taken into the stomach, or any applications to the surface of the body.

The generative organs in the female are not fitted to perform their functions until a certain period of life, namely, from the 13th to the 15th year of age, a period which is termed puberty, and is indicated by the occurrence of menstruation. This period, however, is affected greatly by climate, occupation, education, and many other external circumstances; as well as by the condition of the generative system.

The texture of the uterus is muscular, but the fibres are denser, firmer, and more compact than those of the other muscular textures of the body: it abounds with blood-vessels; the arteries are tortuous, and the veins destitute of valves; it is also well supplied with nerves, and with lymphatics on its external surface. The existence of nerves in the substance of the uterus was long doubted; but modern discovery † has put both this question and that of its muscularity at rest. Internally, the uterus is lined with a soft, delicate, spongy membrane, composed chiefly of capillary vessels. That part of the cavity, however, which forms the canal of the cervix, exhibits a very different surface; it is firm, callous, and little vascular, with oblique and transverse rugæ, which exude a mucous fluid. Such is the organ—what is its function in the unimpregnated state? How far is it adapted to perform the functions of a secreting organ? Is the periodical discharge a true secretion, or a mere flow of blood from vessels oppressed by a local plethora.

In reply to the first of these queries, it is scarcely necessary to say that the function of the unimpregnated uterus is menstruation — a discharge recuring once a month; commencing at the period of puberty, and terminating between the fortieth and fiftieth years of age. The second and third

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* Derived from ἐμμηνια, the menses, and ἀγω, I induce.

† See Dr. Robt. Lee's Investigations.—Phil. Trans. 1842.

queries involve matters of controversy; but the prevailing opinion is in favour of the capacity of the uterus to secrete, and, consequently, that the discharge which it exudes is a real secretion*. There is nothing in the anatomical structure of the organ that unfits it for the function of secretion; like every other secreting organ, the uterus forms its secretion on a free surface, supplied with arteries and veins, anastomosing so as to constitute an extended net-work. The membrane is permeated by the liquid portion of the blood; it effects some change in it, and pours out the matter thus changed as a secretion on its surface †." Were any arguments necessary to refute the notion that menstruation depends on a general plethoric orgasm, it would be only necessary to mention the facts bearing on this point, presented by the Hungarian sisters. These two females were united at the lower part of the back, and lived to the age of twenty-two. The same blood flowed in the system of both; for the abdominal vessels were found, after death, united at the loins; yet the uterine function was distinct in each; it differed in its period, and also in the quantity of the discharge. Were the menstrual discharge a mere flow of blood from dilated vessels, this state would have been long since ascertained in the examination of the various cases which have terminated in death during menstruation; but the closest microscopic investigations have displayed no appearances that give support to such a belief. Others, arguing from the analogy of hæmorrhoids, and the swellings of the uterine veins at the moment of menstruation, have contended that the discharge proceeds by simple exudation of the blood from the uterine veins: but this opinion has had very few supporters. Indeed, in reflecting on the nature of the organ itself, on its resemblance to other glandular organs in the manner in which it is supplied with blood, and on the adaptation of its internal surface to secretion, we can have little hesitation in admitting, that the manner in which the periodical discharge is supplied closely resembles that of a secreted fluid‡. The uterine arteries are not only exceedingly convoluted, but they are larger and have thinner coats than the veins, in the unimpregnated state: blood is therefore brought into the organ readily, and in considerable quantity, whilst it is slowly returned from it—a condition of vessels highly favourable to the secreting function. It is true that, previous to menstruation taking place, there are symptoms indicative of general plethora, as well as of

* This discharge is peculiar to females of the human race, although Cuvier has stated that he has observed indications of it in females among quadrupeds. Rengger noticed a discharge resembling it in the female of Cebus *Azurræ;* but it did not occur at regular periods; and it is undoubted that something like it exists in the monkey tribe.

† Müller's Elements of Physiol. Trans. vol. i, p. 462.

‡ M. Lecanu ascertained that the blood drawn from the arm of a woman during the flow of the menstrual discharge contains little more than one-half the quantity of globules which the blood of the same individual holds at other times.

local congestion; yet this fact only proves that the discharge is connected with such a condition of the system; not that it is caused by this state, nor that the relief which follows is attributable to blood being discharged by the uterine vessels. The admission, also, that there is an increased determination of blood to the organ at the period of menstruation, does not militate against the idea that the discharge is a secretion; since it is very well known that every glandular organ, when excited by its appropriate stimulus, becomes a centre, as it were, to which the blood is directed; and this is strikingly observable in those which are only periodically called into action. Again, if this discharge were merely the effect of local plethora, it would be blood; which is not the fact; for it does not coagulate like blood, nor does it contain fibrin; but "has the properties," as Mr. Brande has remarked, "of a very concentrated solution of the blood in a diluted serum;" an opinion, however, which is stated by Müller to be incorrect. "I have found," says he, "red particles in it perfectly unchanged in appearance*." If it be thus evident, from reasoning, and from the chemical nature of the discharge, that menstruation is not the mechanical result of a local congestion, let us examine how far observation supports the opinion that it is a *secretion.*

We know that glands are excited to the exercise of their secreting function by some specific impression, either mental or corporeal: the salivary glands are excited by the thought of savory food; the testicle is excited to the elaboration and excretion of semen by the desire of sexual intercourse; and it is probable that the action of the uterus is influenced by some state of the ovaries; for when these organs are either absent or are much diseased, no menstruation occurs. The truth of this opinion is supported by the influence which mental affections exert on this secretion; and it is only on the exertion of such an influence that we can explain the defect of the discharge under the depressing passions, hope deferred, and disappointments in the tender passion, which undermine and destroy the female constitution.

It is not possible, in the present state of our knowledge, to explain the periodical return of the menses. As the intervals are those of the course of the moon in the revolution of her orbit, they were supposed to be influenced by this planet; but were this the case, the menses ought to correspond with one of the phases of the moon's course, which is not the fact. *Van Helmont* thought to explain it on the then prevailing doctrine of fermentation; *Stahl* referred it to the vis medicatrix labouring to relieve the female constitution of a superfluous accumulation which occurs monthly; whilst *Gall* endeavoured to prove that some

* Elements of Physiology, trans. vol. i, p. 256.

external cause, which he could not discover, but which is not the moon, influences the period, as he ascertained it to be a general law, that all women menstruate at the same epoch. Without admitting any of these opinions, all of them being as untenable as the hypothetical idea of lunar influence, the truth or error of the theory that menstruation is a secretion does not depend on the necessity of an explanation of its periodical return. Such being the case, it is easy to comprehend that the conditions essential for its perfect formation are—

1. A due supply of blood to the organ.
2. A certain extent of nervous influence.

1. With regard to the supply of blood, it is impossible to say by what power the blood is periodically determined to the organ; but when the period of puberty arrives, if any derangement in the general health interfere with the appearance of the menstrual discharge, different symptoms occur, according as this condition may cause an over supply or a defective supply of blood to the organ.

When the supply is *excessive*, whilst, at the same time, the uterine vessels are torpid, or in a constricted or spasmodic state; the suppression of the secretion is indicated by headache, a flushed countenance, a full pulse, sometimes slow, at other times accelerated, and pains in the back and limbs. It is not difficult to explain this condition, as we know that stimulus, whether of blood or of extraneous matters, if in excess, instead of preventing, diminishes the secreting powers. On the other hand, when the supply is *defective*, the suppression is accompanied with pallidness of the face and lips, cold hands and feet, great lassitude, and the slightest exertion causing fatigue; a loaded tongue, defective and irregular appetite, costiveness, a slow and feeble pulse; hysterical symptoms, melancholy, and hallucinations; and frequently with that condition of the habit, which, for the greenish tint which it imparts to the skin, has been termed *Chlorosis*.

2. As far as regards the nervous influence, the organ, under suppression from either of the causes which have been described, may be affected with great irritability, with which the general system may sympathize, and hysteria or epilepsy, or some form of convulsions supervene; or palpitation of the heart, or distressing cough, or dyspnœa, may be produced.

The uterus, as has been already stated, resembles a gland in its vascular structure; and this resemblance extends to its diseases—an inflammatory state excited in it being often followed by scirrhus and cancer. Like other secreting organs, also, its function is often imperfectly performed, and the secretion, therefore, is liable to vitiation and derangement. In the first efforts of the organ, the secretion is usually thin, colourless, and deficient, and its recurrence is irregular and protracted: when it is

suppressed, it cannot be restored by inducing plethora; nor can the flow, when it has commenced, be checked by venæsection, nor by any other means of depletion. In making this remark, I must not be misunderstood: it is not my intention to assert, that inordinate evacuations in other parts of the system do not influence the uterine discharge; on the contrary, I am perfectly aware that preternatural evacuations induced in the other organic systems will suspend the flow of the menstrual discharge, on the same principle that increased action of the intestinal system suspends the action of the cutaneous exhalants; and, *vice versa*, sweating checks diarrhœa. Any argument, founded on the supposition that the structure of the uterus is not sufficiently glandular for a secreting organ, falls to the ground, when we reflect that the gastric juice is secreted by the stomach, which is more simple and less like a glandular organ than the uterus. I shall only add, that the correctness of the opinion that the menstrual discharge is a secretion does not depend altogether on circumstances connected with the state of the organ itself; experience having ascertained that this discharge is much influenced by the condition of the ovaries. It is not necessary, for the establishment of the truth of this opinion, that we should be able to explain the cause of the periodical return of the discharge.

If menstruation depend, as I maintain it does, on the secreting function of the uterus, it is obvious that, in the unimpregnated state, it ought always to happen at its regular period, when the organ is in a natural or healthy state; and that, in order to promote its return, when it is interrupted or suspended, such medicines must be employed as will restore the organ to that precise state or condition on which the exercise of that function depends. It may be doubted, however, whether there are any medicines which will excite the flow of this discharge by stimulating immediately the nerves and vessels of the uterus, in the same manner as the kidney is stimulated by medicines which are carried into the system and pass directly to that organ. But it cannot be denied that some medicines appear to act more directly upon the uterine system than others; and it is to these that the appellation Emmenagogue is properly applied. They may be such as will act either immediately on the uterus itself, or such as will merely influence that organ as a part of the general system. Emmenagogues, therefore, may be arranged under two heads—*direct* and *indirect*. We can understand the manner in which both operate, and the propriety of employing the one or the other, if we have a clear idea of the nature of the morbid condition of the organ, and whether the obstruction or interruption of the periodical discharge depends on a diseased state of the uterus itself, or is the effect of the presence of other diseases in the system.

In some instances, suppression of the menstruation is a

primary affection, "often," as Dr. Denman has justly remarked, "though not universally, succeeded by a certain train of untoward symptoms*:" but more frequently it is the result of other diseases; and, therefore, the nature of these, as well as the state of the patient, with respect to vigour and constitution of body, must determine the kind of remedial agents to be selected as Emmenagogues. Thus, when the delay of the regular return of the discharge, after it has once appeared, occurs in females with a pale or leucophlegmatic countenance, indicating an atony of the vital powers, stimulant and tonic means are required, to give to the vascular system that degree of power which is requisite to maintain the healthy action of the capillaries; on the contrary, when the complexion is florid, when there is much tension of the system, or when the suppression is connected with great irritation of the uterine system, it is easy to understand that menstruation is more likely to be aided by whatever diminishes excitement and sooths and calms irritation, than by stimulants. Different, nay, very opposite, remedies are required to remove amenorrhœa in different instances. Stimulants, whether corporeal or mental, undoubtedly tend to an early development of the uterine organs, and consequently to the appearance of menstruation sooner than is usual: thus, in tropical climates—in the heated atmosphere of cotton factories—and in those females who indulge in luxurious and pampering habits, the age of puberty is earlier than in those who inhabit the temperate and frigid zones, and whose regimen and passions are better regulated. The continued influence of stimulants is said, also, to prolong menstruation beyond the period of life at which it usually ceases; but this is at least problematical. All Emmenagogues are more or less excitants; and, in cases in which a stimulant influence is contraindicated, they cannot be employed until the excitement be reduced, and then only under certain restrictions. When the uterine obstruction is accompanied with a *pale* complexion and a languid state of the system, a variety of medicines are prescribed, either with the view of directly influencing the *uterus*, and promoting the menstrual discharge by some specific action, or by invigorating the habit, and eventually promoting the secretory function of the organ. Medicines of this kind, however, do not always bring on the menstrual discharge, although they improve greatly the general health. Some topical excitants are also useful; but, by their indiscreet employment, much injury may be done to the organ itself. It ought, besides, to be well understood, that idiosyncracy, natural conformation, diseased states of the uterus itself, or of the ovaries, are often opposed to the salutary influence of Emmenagogues.

* Introduction to Midwifery.

It may be doubted, as I have already mentioned, whether there is any medicinal agent which, when taken into the stomach, will exert a directly stimulant influence on the uterus; but, if we admit that some substances find their way to particular organs—for instance, nitre to the kidneys—there is no reason why such should not take place with regard to the uterus: experience, however, has not yet demonstrated that this is the case; but a stimulant effect may be propagated from neighbouring parts to the uterine vessels: hence, some cathartics, which operate chiefly upon the rectum, are found to influence the uterus.

When the obstruction is accompanied with a *florid* complexion, and the colour of the cheeks is the flush of disease, not the glow of health*, or when a slight cough, with pain in the chest and difficulty of breathing, accompany the suppression, bleeding, and other antiphlogistic means of treatment, must be resorted to, before taking into consideration the means necessary to promote uterine function; and, until the general excitement be subdued, the employment of Emmenagogues would be injurious. It is questionable whether, in these cases, any of those substances supposed to act directly upon the uterus should be employed? If they can be administered, they will be most likely to prove beneficial when given immediately after the reduction of febrile excitement.

The employment of Emmenagogues is not confined to cases of simple obstruction or suppression. In some females, the pain with which menstruation is accomplished embitters much of life. This either indicates a peculiar state of the organ, or it is the effect of disease, or at least a tendency to it, in the organ itself; not, as is sometimes supposed, an increased degree of the irritability of the general system. Some of the substances employed as Emmenagogues are supposed directly to lessen uterine irritation, and consequently to facilitate the discharge; hence they are thus closely allied with sedatives and antispasmodics.

In the following table of Emmenagogues, I have arranged the substances under two distinct heads; the *first* containing those which are supposed to operate, by their stimulant influence, on the uterus itself: the *second* those which influence the uterus sympathetically by their action on other organs: or, into *Direct* and *Indirect* Emmenagogues. The first of these divisions I have subdivided into *Immediate* and *Mediate*. In the second of these subdivisions, some substances will be found, the direct influence of which on the uterus is doubtful: they maintain their place rather in conformity with the prevailing opinions, than from a conviction that their action on the uterine system is such as to authorize the position which they hold.

* Denman.

TABLE OF EMMENAGOGUES.

A. DIRECT EMMENAGOGUES.

1.—Immediate.

a.—ELECTRICITY. *Electricitas.*

2.—Mediate.

* *Organic Products.*

b.—OLEO-RESINS—contained in

Roots—Polygala *Senega.*	17.	3.	Polygalaceæ.
Ruta *graveolens.*	10.	1.	Rutaceæ.
Herb.—Juniperus *Sabina.*	22.	8.	Coniferæ.

c.—BITTER PRINCIPLE—contained in

Roots—Rubia *tinctorum.*	4.	1.	Galiaceæ.

* * *Inorganic Substances.*

d.—MERCURIALS. *Preparationes Hydrargyri.*

B. INDIRECT EMMENAGOGUES.

1.—operating on the kidneys and intestinal canal.

a.—NITRATE OF POTASSA.

b.—BITTER PRINCIPLE—in Proper Juice of

Aloë *Socotrina.*	6.	1.	Liliaceæ.
—— *Spicata.*	–	–	———
—— *vulgaris.*	–	–	———
—— *hepatica.*	–	–	———

c.—GUM-RESIN—contained in

Roots—Helleborus *niger.*	13.	7.	Ranunculaceæ.
———— *Capensis.*	–	–	
———— *orientalis.*	–	–	
Twigs—Hebradendron *Cambogioides.*	23.	1.	Guttiferæ.

2.—operating on the stomach.

* *Organic Substances.*

d.—VOLATILE OIL—contained in

Roots—Valeriana *Officinalis.*	3.	1.	Valerianaceæ.
Aristolochia *Serpentaria.*	20.	1.	Aristolochiaceæ.
Herb—Artemisia *Asinthium.*	19.	2.	Asteraceæ.

* * *Inorganic Substances.*

e.—OXIDES AND SALTS OF IRON. *Oxydi et Ferri Sales.*

Black Oxide of Iron.

Carbonate of Iron.

Sulphate of Iron.
Ammoniated Iron.
Potassio-tartrate of Iron.

3.—operating on the nervous system.

* *Animal Productions.*

f.—Castor—formed by the
Castor *Fiber.* 1. 4. Rodentia.

* * *Vegetable Substances.*

g.—Oleo-Gum-Resins—contained in
Ferula *Assafœtida.* 5. 2. Umbelliferæ.
Galbanum *Officinale.* 5. 2. ————

h.—Digitalia—contained in
Digitalis *purpurea.* 15. 1. Scrophularinaceæ

i.—Unknown Principle—contained in
Ergot. — — Fungaceæ.

A. DIRECT EMMENAGOGUES:

1.—OPERATING CHIEFLY ON THE NERVOUS SYSTEM.

1. IMMEDIATE.

a. Electricity. *Electricitas.*

If a discharging rod attached to a chain communicating with the outside of a charged Leyden jar be applied to the one side of the pelvis, and the knob communicating with the inside of the jar be applied to the opposite side, a sensation is instantly felt as if a small sword was thrust through the part; and a stimulant impulse is given to the uterus by the direct passage of the electrical fluid through it. The impulse of a shock thus communicated is obvious by the sensation which it excites; but excitement also takes place, although in a less degree, when no sensation is produced, as when a continued current of the fluid is passed through the organ, by making it a part of a circuit communicating with the prime conductor of an electrical machine, or in making it part of a Galvanic circle. The direct application of electricity is admissible only when a torpor of the uterus exists, indicated by a suppression of the catamenia, with a pale complexion, and a languid state of the circulation. But, even in this condition of the habit and the organ, it should be remembered that, whilst applied in moderation, this agent rouses the activity of the torpid uterus, in large quantity, it injures materially, if it does not altogether destroy, the excitability of the organ.

When the complexion is florid, particularly if febrile symptoms, with some oppression of respiration, be present; bleeding, purging, and antiphlogistic measures, instead of electricity, are required. In employing electricity, therefore, as an Emmenagogue, it should be first used under the form of accumulated electricity, or the bath, as it is termed; then sparks; next the aura; and, lastly, shocks should be given. At first, the shock should be moderate; as, in nervous habits, syncope has followed the indiscreet communication of powerful shocks; but, with ordinary caution in its application, Electricity has been found a salutary agent in amenorrhœa depending either on general debility of the system or on atony of the organ itself.

2. MEDIATE.

* *Organic Substances.*

b. Root of Dyers' Madder. *Rubia Tinctorum, Radix.* D. —Rubia Tinctorum is a native of the Levant and the South of Europe; but it has been long cultivated in Zealand for the use of dyers. It belongs to the natural order Galiaceæ*. The stem is quadrangular, with sharp pods in the angles, brittle, rough, and diffuse. The leaves in whorls, lanceolate, mucronate, with pinnated veins. Flowers small, white, with parted, rotate corolla, having ovato-lanceolate lobes. The fruit is didymous, globose, baccate, and juicy. The dried roots are somewhat translucent, reddish, and have a strong odour. When perfectly dried, they are pulverized so as to produce three descriptions of powder. The first and second, called *ombro, gamone,* and *mull,* consist chiefly of the fibrillæ and skins of the larger roots; the second is a little better only; it is the third, which is called *Crop Madder,* that is imported for medicinal use.

Good Madder has a bitter, slightly harsh taste. It attracts powerfully the moisture of the atmosphere, and is injured when it becomes damp. It imparts a pink hue to water at 60°; but when the fluid is boiled, a deep brown tint is produced. Its chief constituents, according to Buckley, are 1·2 of a *red resinous colouring matter,* 39·0 of *red extractive,* 1·9 of a *reddish-brown substance,* soluble in potassa and hot alcohol, 0·6 of *pungent extractive;* 9·0 *gum,* and 4·6 of a *matter soluble in potassa,* the remainder are *lignin, water,* and *salts of lime*†. The decoction is precipitated by chloride of tin, diacetate of lead, alum, the alkaline carbonates, and lime-water. The colouring principle of the plant has been ascertained by Robiquet and Collin to be a peculiar acid, which they have named *Alizarin.* It is procured by digesting the Madder in four parts of sulphuric ether,

* Hayne, x, 14. Lindley, 446. † Gmelin, Hand. d. Chim. ii, 1280.

evaporating to the consistence of syrup, and when it is dried spontaneously, it is reduced to powder, and sublimed into a cone of paper. It sublimes in yellowish-red, brilliant, diaphanous, acicular crystals. Carbonate of magnesia imparts to the infusion a bright blood-red colour; and, when evaporated, leaves a residue very readily soluble in water, which is an alizarinate of magnesia. Its constituents are $C.^{37}$ $H.^{12}$ $O.^{10}$ When agitated with chlorine gas, the extractive is oxidized.

As an Emmenagogue, Madder has been long employed and relied upon, without any certainty as to the manner in which it acts; although, from its tinging the urine, as well as the bones, of a red colour, it has been supposed that, as it passes into the circulation, it finds its way to the uterus, and directly influences that organ. The late Dr. Barton, an American physician of considerable eminence, placed great reliance on its deobstruent powers; and it was also much esteemed by the late Dr. Home, of Edinburgh, who, in his "Clinical Experiments and Histories," has recorded his decided opinion of its efficacy as an Emmenagogue*. He gave it in doses of from ʒss to ʒii twice or three time a day. It is now rarely employed.

OLEO-RESINS.

The volatile oil, in combination with resin, is the active principle of the following substances.

* *Roots.*

1. Senega Root. *Senega Polygalæ.* L. E. *Senegæ Radix.* D. —Senega Root (p. 996) contains an acrid resin, volatile oil, and a large proportion of sweetish-bitter extractive.

As an Emmenagogue, Senaga Root was first employed by Dr. Hartshorne, of Philadelphia. He found that its efficacy is most conspicuous in recent cases of amenorrhœa, when it is administered in the form of a saturated decoction, to the extent of a pint in twenty-four hours, beginning its use about two weeks previous to the menstrual discharge. It is, however, necessary to state, that he previously prepared the habit, as he expressed himself, by the administration of calomel, carried to the extent of producing a gentle ptyalism; and something must be referred to the action of the mercurial on the uterus, independent of the Senega. The experience of Dr. Chapman, another American physician, and Professor of Materia Medica in the University of Pennsylvania, is thus stated by him. "I have," says he, "tried the Senega, both in my public and private practice, to a considerable extent, and with sufficient success to warrant

* Clin Exp. 2nd edit. p. 422.

me in recommending it as one of the most active, certain, and valuable of the Emmenagogues. The Senega," adds Dr. Chapman, "may be used either in powder or in decoction, though I greatly prefer the latter mode. My rule," he says, "in the administration of the medicine, in these cases, is to give about four ounces of the decoction, more or less, during the day, according to the circumstances of the case. But at the time when the menstrual effort is expected to be made, and till the discharge is actually induced, I push the dose as far as the stomach will allow, having given as much as two ounces every hour."

"In the intervals of the menstrual periods," Dr. Chapman continues, "I always lay aside the medicine for a week or two, as, without these intermissions, if it does not lose its efficacy, it becomes nauseous and disgusting to the patient. While under a course of Senega, the general system is to be kept properly regulated, equally obviating excessive excitement or debility, by the use of the appropriate remedies. Of all the Emmenagogues which I have tried," he adds, "this is the most efficacious, and will be found useful in all the forms of amenorrhœa; but I think it to be more particularly so in those cases where decidua exist. As yet we are ignorant of the exact process by which this membrane is formed; though of this there is no doubt, that the vessels of the uterus, which pour out the catamenia, are the instruments by which it is accomplished. Nor is it less certain that, while they are engaged in the formation or support of this new production, menstruation ceases, the two offices exciting modes of action totally incompatible. It is obvious, under these circumstances, to change the state of the uterus, and to excite a secretory effort, not only a forcible, but a specific impression must be made upon it. Deny to the Senega these specific energies, and where shall we seek an explanation of its effects? Were it simply a stimulant, or tonic, or sudorific, as is more generally supposed, it might induce excitement, or impart tone, or raise a diaphoresis, like many other articles of the Materia Medica; but would it be so signally efficacious as an Emmenagogue?" I have extracted this long quotation from Dr. Chapman's work to make up for the want of any remarks which my own experience enables me to make on the employment of this medicine in the treatment of amenorrhœa. If his remarks be correct, the Senega Root is undoubtedly an Emmenagogue which merits more attention than it has received on this side of the Atlantic. The powder may be given in doses of gr. x to ℈i.

Decoction of Senega. *Decoctum Senegæ.* — Take ʒx (ʒiii, D.), Oii (Oiss *old wine measure*, D.), boil down to Oi (f℥xviii, D.) and strain. The dose is f℥i to f℥iii.

2. Rue. *Ruta.* L. E. *Ruta graveolens folia*, D.—This plant

is a native of the South of Europe, although it is generally cultivated in this country as a garden shrub. It belongs to the natural order Rutaceæ*. It is an herbaceous shrub, rising about two feet in height, with glaucous, alternate, supradecompound leaves, covered with transparent dots; the lateral lobes are nearly linear, the terminal obovate: the uppermost leaves are simply pinnate. The flowers are in terminal, leafless, trichotomous cymes. The fruit is 4-lobed, roundish, warty, opening by two valves.

The only analysis of Rue is that of Mähl, who found it to contain *volatile oil*, *bitter extractive*, a *vegeto-animal matter*, *mallic acid*, *gum*, *albumen*, *starch*, and *chlorophylle*†.

Rue is a powerful excitant, operating on the tissue to which it is applied, as well as generally on the capillary system. That it operates upon the uterine organs is manifest, from miscarriage having followed its employment in poisonous doses‡. Rue was, indeed, esteemed a useful remedy in obstructed menstruation so early as the time of Hippocrates. The oil should be preferred to the Confection, Syrup, or Extract of the plant, in amenorrhœa. In the form of an oleo-saccharum, it may be administered to the extent of two or six minims for a dose.

* * *Leaves.*

3. Savin Leaves. *Sabina*, L. E. *Juniperus Sabina, folia.* D.—Savin is a native of the South of Europe and Asiatic Russia, belonging to the natural order Coniferæ §. The plant is a compact, spreading shrub: the branches are round, slender, tough, and closely invested with short, acute, imbricating leaves; the fruit is a cone (*galbulus*), irregularly round, about the size of a small pea, and of a deep bluish-purple colour.

The leaves and tops of Savin have a strong, disagreeable odour, and a hot, acrid taste, depending on a volatile oil, which can be obtained separated from all the parts of the plant by distillation with water. It is limpid, nearly colourless, has the strong odour of the plant, a bitter acrid taste, and sp. gr. 0·915. Its constituents are 10 eq. Carbon = 61·20, + 8 Hydrogen = 8, equiv. 67·20. Savin, or rather the volatile oil of the plant, is an energetic Emmenagogue; and, from the activity and mode of its action, and its proneness to produce uterine hæmorrhage, there is reason for thinking that it is taken into the circulation, and carried directly to the uterus, on which it exerts its stimulant influence. Experience, indeed, has amply confirmed the power of Savin as an Emmenagogue; but it has besides proved that much caution is requisite in its administration, to prevent inflam-

* London Dispensatory, art. Ruta. Richard, Hist. Nat. Med. t. ii, p. 279. Hayne, vi, 8. Lindley, 210.

† Pfaff. Mat. Med. iv, 339.

‡ Lond. Med. Gaz. xxiv, p. 171.

§ London Dispensatory, art. Juniperus. Richard, Hist. Nat. Med. t. i, p. 471. Nees von Essen. 87. Lindley, 557.

mation of the uterus. Dr. Dewes has recorded a fatal case of its employment as an Emmenagogue*. It is adapted for those cases of amenorrhœa only which are attended by a pale countenance and languid circulation. More than half a century ago, it was lauded as an Emmenagogue by Dr. Home†; but, from the opinion of it expressed by Dr. Cullen soon afterwards, it was neglected, and has never since entirely regained the reputation it merits. M. Herz, a German writer, has also borne testimony to its beneficial influence as an Emmenagogue. It may be administered in substance, in the form of powder, in doses of from five to ten grains; or the oil may be given as an oleo-saccharum, in doses of from two to six minims, combined with ten grains or a scruple of sugar. It is sometimes ordered in the form of infusion, made with ʒi of the fresh tops and f℥viii of boiling water: the dose being from fʒiv to f℥iss.

** *Inorganic Products.*

MERCURIAL PREPARATIONS. *Hydrargyri Preparationes.*— No medicines, perhaps, merit more the appellation of Direct Emmenagogues than the preparations of Mercury. If the correctness of the view which has been taken of the function of the uterus be admitted, there is little difficulty in conceiving that the administration of mercurials in obstructed or suppressed menstruation is likely to prove salutary. They operate almost a specific change upon the whole glandular system; and, consequently, regarding the uterus as a secreting organ, if its functions be altered by disease, the same medicines which affect the capillaries in general, are likely to operate on those of the uterus, when they are in a morbid condition. Mercurials, carried to the extent of exciting a moderate degree of salivation, have relieved amenorrhœa when every other method of treatment has failed. The preparation best suited for this purpose is Calomel. It is mild in its operation, and, at the same time, it is one of the most certain in its influence on the general system. In the combination in which it exists in Plummer's pill, in particular, it has been found highly beneficial, the oxy-sulphuret of antimony with which it is combined greatly aiding its power. It may be given in doses of from gr. v to gr. xii every night and morning, until the gums be sensibly affected.

Upon the whole, from what has been said, it is obvious that Electricity is the only direct Emmenagogue, and that the idea

* Syst. of Midwifery, p. 133. † Clin. Experiments, p. 419.

of the others acting upon the uterus itself is rather inferred than certain. It is nevertheless true, that, in whatever manner they act, Emmenagogues stimulate the uterus; and, therefore, some caution is requisite to be observed in their administration. We must be certain, in the first place, that the suppression is not connected with pregnancy, as not only abortion may be induced, but inflammation of the uterus may be set up, and lay the foundation of an organic disease of the uterus: in the second place, we must ascertain that the uterus is not in such a state of active disease as to render their influence upon it hazardous.

B. INDIRECT EMMENAGOGUES.

These consist of substances which influence the uterus through the medium of some other organ. This may be effected in three ways:—1. By the substance operating on the kidneys or intestinal canal, and stimulating the uterus by proximity. 2. By the substance operating on the stomach and improving the general health, so that the uterus may share the salutary influence. 3. The uterus may be specifically influenced through the medium of the nervous system.

1. *Substances operating on the Kidneys and Intestinal Canal.*

The substances which produce emmenagogue effects, by their operating on the kidneys and intestinal canal, are diuretics which pass to the kidneys undecomposed, and cathartics that stimulate the rectum.

a. Nitrate of Potassa. *Potassæ Nitras.* L. E. D. (p. 370).—In some experiments made upon women forming part of a society established at Leipsic for therapeutical purposes, Nitrate of Potassa was found to possess decided emmenagogue powers when given in doses of from ℈i to ʒi, dissolved in any bland fluid. I have had no experience of its influence as an Emmenagogue.

b. BITTER PRINCIPLE.

Aloes. *Aloë.* L. *Aloë Barbadensis, Aloë Indica, Aloë Socotrina.* E. *Aloë hepatica, Aloë Socotrina.* D. (p. 887).—Aloetics have the property of stimulating the rectum; and their influence on the uterus can only be referred to the contiguity of this action on the rectum, and its extension to the uterus, producing a state of the organ closely allied to that which is the result of the application of a direct stimulus. The powerful sympathetic influence of aloetics is well illustrated by the effect which frequently follows their administration after the total cessation of the catamenia. For some time after this event occurs, the uterus retains the disposition to resume that state of vascular action which determines the

periodical discharge. In this condition of uterine susceptibility, the excitement of the rectum by an aloetic purgative almost invariably induces the return of the menstrual discharge in a slight degree, provided the purgative be given at the period when the discharge had previously been accustomed to appear. Now, if a cathartic is capable of producing so powerful a sympathetic action when this uterine function has ceased to be any longer essential, we can readily imagine that a more powerful effect is likely to be the result of a similar extension of the action from the rectum to the uterus, at a period of life when the susceptibility of impression must necessarily exist in a high degree. Experience has demonstrated that such an extension of action really occurs. In prescribing Aloës, however, as an Emmenagogue, the cause of the suppression must be kept in view; for this medicine cannot be safely administered in an irritable condition of the uterus. To secure its emmenagogue effect, it is supposed necessary to administer Aloës in a solid form, owing to the idea that its influence on the rectum depends on its slow solution; but, as I have elsewhere stated, this supposition is founded on a mistaken idea of its mode of acting: it is equally efficacious whether given in substance or in solution; and indeed I have seen it most generally successful when administered in combination with alkalies, which greatly aid its solubility. The administration of a pill composed of a grain of calomel, the same quantity of foxglove, with two or three grains of the extract of conium, at bed-time, followed in the morning by half an ounce of the vinous solution of Aloës and myrrh, in conjunction with the carbonates of soda and of ammonia*, for two or three days previous to the expected return of the menstrual discharge, has in my hands generally proved successful.

Aloës form a component of eighteen preparations in the British Pharmacopœias. Those in which it is combined with myrrh or with assafœtida, under the title of Pilula Aloës c. Myrrh, and Pilula Aloës et Assafœtida, are the most useful as Emmenagogues.

c. GUM-RESINS.

These substances exist in vegetable bodies; but two only are employed as Indirect Emmenagogues—namely, the root of the Black Hellebore and Gamboge.

1. Roots of Black Hellebore. *Helleborus.* L. E. *Helleborus Niger, Radix.* D. (p. 925).—This drastic cathartic has been found useful as an Emmenagogue in plethoric habits, probably from its influence in reducing that state of the system which is as adverse to the secreting action of the uterus as to that of every other glandular organ. Black Hellebore was introduced as an

* London Dispensatory, 6th edition, p. 941.

Emmenagogue by Dr. Mead, who gave it in the form of Tincture, in doses of f℥ii, in a glass of warm water, twice a day*. It continued to be much employed, until doubts of its efficacy were raised by Cullen and Heberden†, after which it fell into disrepute; but it is still much prescribed on the continent of Europe and in the United States of America. Dr. Chapman thus expresses himself respecting it:—"It has many just pretensions. It is especially useful when it purges, in painful menstruation, attended with torpor and constipation of the bowels, and perhaps with some degree of insensibility in the uterus itself. The powder," he adds, "is given in doses of ten grains, in the form of pills, which may be repeated for several days‡." How far its action as an Emmenagogue can be relied upon, my experience does not permit me to offer an opinion. From the violence of its action as a drastic purgative, it requires to be administered with caution. The tincture is the best form of preparation: it possesses all the active properties of the root, and may be added to any purgative, and thus aid in stimulating the uterus, with less risk than is likely to attend the use of the root or its infusion. The powdered root may be given in doses of gr. x to ℈i.

Tincture of Hellebore. *Tinctura Hellebori.* L.—Macerate ℥v of bruised Hellebore Root in Oii of proof spirit, for fourteen days, and strain. The dose is f℥iv to f℥i.

2. Gamboge. *Cambogia.* L. D. *Cambogia Siamensis. Cambogia Zeylanica.* E.—Camboge gripes more than Aloës, and is as drastic in its operation as Hellebore; therefore, as it possesses no peculiar advantages that I know of, to secure it a place in the list of Emmenagogues, unless it be as an auxiliary to other purgatives, it might be advantageously rejected.

2. *Indirect Emmenagogues operating on the Stomach.*

Emmenagogues which operate through the medium of the stomach are tonics of a stimulant character, which owe their efficacy to volatile oil; and the salts of iron.

* *Organic Products.*

d. VOLATILE OIL.

* *Roots.*

2. Serpentaria Root. *Serpentaria.* L. E. *Aristolochia Serpentaria, Radix.* D. (p. 37).—This stimulant tonic produces

* Opera.

† Heberden remarks, "Radix Hellebori Nigri facultatem movendi menstrua sibi vindicavit, quam tamen nullo satis firmo argumento usus mihi confirmavit."—Commentarii, cap. 62.

‡ Materla Medica.

emmenagogue effects by the influence it exerts on the capillary system. It is given in the same dose and under the same circumstances as when it is employed as an excitant.

1. Valerian Root. *Valeriana.* L. E. *Valeriana Officinalis, Radix.* D. (p. 518).—Valerian appears to exert its influence on the nervous system, first as a stimulant, and afterwards as a sedative. On these properties its influence as an Emmenagogue, as well as in relieving spasm, certainly depends. Dr. Heberden states that he has seen persons thrown into strong agitations by its use; and, from its effects upon cats, he is disposed to admit its influence on the nervous system to be considerable. Its power, nevertheless, is greatly affected by circumstances: thus, the powder, in large doses, has been taken by some individuals without producing any effect, whilst the same quantity of the same powder has caused in others manifest action on the brain; displayed by a sensation of weight in the head, and a sense of fulness in the alimentary canal, flatulence, colic, and tenesmus. To such individuals Valerian ought not to be administered; and it is also contra-indicated in congestion of the brain. Experience has amply demonstrated its value in amenorrhœa, in hysterical females; but whether the benefit be derived from its influence on the general system, and the uterus sympathizing with it, or whether it have any direct action on the organ itself, admits of a question. Its employment, except in cases of uterine irritation, is not very extensive.

Valerian is sometimes administered in substance, in combination with aromatics; but the powder is a bad form, on account of the largeness of the dose, less than ʒi scarcely ever producing any effect. It is only in this form, however, that it operates on the abdominal viscera. An extract of it is ordered by the Dublin College; but the volatile oil being dissipated in preparing it, this, like all extracts of plants containing volatile principles, is objectionable. As water takes up all the active principles, the infusion might be supposed to be an excellent form; but the effects of the infusion are much less permanent than those of the powder; and in this form Valerian seems to operate chiefly on the nervous centres. There are two tinctures of Valerian; one made with alcohol, the other with the aromatic spirit of ammonia: both are frequently ordered in conjunction with bitter infusions; but neither can be properly combined with decoctions of astringent vegetables, as an insoluble precipitate is produced, by which the efficacy of both medicines is lessened. The alkaline wine of aloës is the most useful addition to Valerian, when it is administered as an Emmenagogue.

* * *Herbs.*

3. Common Wormwood. *Absinthium.* L. E. *Artemisia Absinthium summitates florum.* D. (p. 519).—Wormwood, as an

Emmenagogue, is much inferior to either Valerian or Serpentaria. It has been administered, however, with advantage in cases of amenorrhœa depending on diminished energy of the uterus, in hysterical and hypochondriacal individuals. It may be administered either in the form of powder, in doses of from ℈i to ℈ii; or in that of infusion, made with ℥i of the dried plant and f℥xii of boiling water, in doses of f℥iss. The Dublin Pharmacopœia contains an extract of Wormwood; but if the powers of the plant depends on its volatile oil, this is a bad form of preparation.

* * *Inorganic Substances.*

The Inorganic Substances employed as indirect Emmenagogues, producing their effects by their influence on the stomach, are salts of iron, both natural and artificial.

1. NATURAL SALTS OF IRON.

The natural salts of iron, employed as indirect Emmenagogues, exist in a state of solution in *Chalybeate Waters*. All these waters are styptic to the taste, and strike a blue-black with infusion or tincture of galls, and a blue with ferrocyanate of potassa. The iron is generally in the state either of a carbonate dissolved in carbonic acid, or of a muriate or a sulphate. The principal waters of this description, in this country, are those of Tunbridge, Brighton, Cheltenham, Sandrock in the Isle of Wight, and Peterhead. The Bath waters also contain a small quantity of Iron. In the waters of Tunbridge and Cheltenham, the Iron is held in solution by carbonic acid, which exists in the Tunbridge waters in the proportion of eight cubic inches in each gallon. The Iron is contained in the state of a carbonate; but when the water is exposed to the air, the carbonic acid escapes, and the oxide of iron, attracting an additional portion of oxygen, is converted into a sesquioxide, and, becoming insoluble, is precipitated in the form of a red or ochreous deposite. On this account, these waters are most beneficial when drank at the spring; or, if they be conveyed to a distance, they should still afford the inky colour when tested with infusion of galls; otherwise they are of no value as Emmenagogues. The other ingredients in chalybeates of this description, are minute quantities of sulphate of soda, chloride of sodium, chloride of calcium, and magnesium and carbonate of lime, which produce no effect on the uterine system. The Peterhead spring resembles those of Tunbridge and Cheltenham.

In the Brighton and Sandrock springs, the Iron is contained in the state of a sulphate. These waters are not decomposed by exposure to the air; and, even after being boiled, they answer to the tests of the presence of Salts of Iron.

Both these kinds of chalybeate waters operate as powerful stimulant tonics, although, in neither, the Salt of Iron exceeds

three grains in a gallon of the water. Soon after drinking the usual dose, half a pint, of any of them, the pulse rises in strength, and a glow is felt over the frame. In plethoric individuals, nausea, vomiting, pain of the præcordia, a sensation of weight in the head, slight vertigo, and a feeling of general fulness, are frequently experienced on first drinking the waters; and, if these symptoms do not abate, the use of them should either be discontinued altogether, or should be intermitted, and the patient be bled and purged before their use is resumed. All the varieties of chalybeate waters prove useful in amenorrhœa, connected with a pale, leucophlegmatic, or chlorotic state of the habit. Their influence is on the secretory system, on which they operate in a slow, but uniformly progressive manner, imparting tone, nervous energy, and general vigour; and in these benefits the uterus shares. In commencing a course of chalybeate waters, if the tongue be furred and the bowels irregular, indicating a disordered state of the alimentary canal, a gentle emetic and a purgative should be administered before taking the waters; and, when the habit of the patient is sluggish, pills, aloës and myrrh, may be administered with each dose of the water. The whole quantity of the water necessary to be taken in one day should be drunk in divided doses, between each of which, brisk walking exercise should be used. The beneficial effects of these natural solutions of the Salts of Iron in chalybeate waters most probably depend on their very minute division; but this is not the sole cause, as no artificial imitation of a chalybeate water, however accurate, produces beneficial effects equal to those of the natural springs. It must also be noticed, that these waters are most successful when they are drunk at the fountain-head—a fact which throws considerable light on the cause of the superiority of the natural waters over their artificial imitations. Certainly it is not in towns, in the busy haunts of men, amidst anxieties and rankling cares; nor in situations which tempt us to join in the dangerous enjoyments of the festive board, nor while attending the nocturnal assemblies of heated drawing-rooms, or crowded theatres; that any remedial agent can be expected to produce a salutary effect: and, therefore, we cannot wonder that a chalybeate, taken in such an unnatural condition of life, produces a less salutary effect than when drunk at the spring.

2. ARTIFICIAL SALTS OF IRON.

The tonic effects of Iron, in combination with those agents which give activity to metals, chlorine, iodine, oxygen, and acids, have been acknowledged, and are verified by every day's experience. Its salts have been long known as well adapted for cases of amenorrhœa, connected with a feeble state of the general frame. All the preparations of iron, indeed, are useful Emmenagogues.

A common form of administering Iron in amenorrhœa is that of the BLACK OXIDE of the Edinburgh and Dublin Colleges—the scales from the anvil, purified. This is a compound of two oxides of Iron, in uncertain and inconstant proportions. The protoxide in the preparation of the Black Oxide, from its combining with the acid of the stomach and giving out hydrogen gas, in decomposing the aqueous contents of that organ, has the inconvenience of producing acid eructations. The dose is from gr. v to ℈i, two or three times a day. It may be combined with aromatics.

The FERRO-CHLORIDE OF AMMONIA is a more valuable preparation; but the most efficacious preparations, as Emmenagognes, are the SULPHATE and the TINCTURE OF SESQUICHLORIDE OF IRON. The Sulphate may be combined with myrrh, aloës, or galbanum; the Tincture of SESQUICHLORIDE OF IRON may be added to any tonic bitter which does not decompose it; as, for example, infusions of quassia, gentian, and cascarilla. The sulphate should always be in the form of the protosulphate; and, therefore, as this salt is rapidly converted into the persulphate, it should be preserved in alcohol. The compound mixture of iron of the London and Dublin Pharmacopœias is intended to be a carbonate of iron, suspended by the gummy matter of the myrrh in water: but if the bottle containing it be not quite full, or if it be not kept completely closed, oxygen is rapidly attracted from the air, and the carbonate is transmuted into the insoluble inert sesquioxide of iron. This is demonstrated by the change of colour which takes place when the mixture is exposed to the air. If made at the time it is to be used, however, it is an excellent Emmenagogue, in doses of f℥i, given twice or three times a day. The quantity of the protosulphate proper to mix with f℥iss of the mixture of myrrh and carbonate of potassa is four grains. Its influence is perceived by the rapid change which it induces on the alvine and renal evacuations; the black colour of the former, and the blue streak when the latter is tested with ferrocyanate of potassa, demonstrating that the chalybeate has entered the circulation.

3. *Indirect Emmenagogues operating on the Nerves.*

* *Animal Productions.*

f. CASTOR (p. 512) has been regarded as a beneficial Emmenagogue when the suppression of the catamenia is connected with spasm and hysteria. It is not, however, an Emmenagogue of much value. Dr. Alexander affirms that it produces very little sensible effect upon the habit in much larger doses than those in which it is usually given; and he consequently condemns it as a useless and inert substance.

* * *Vegetable Substances.*

f. OLEO-GUM-RESINS.

1. ASSAFŒTIDA, L. E. D. (p. 513), must be regarded rather as a useful addition to other Emmenagogues than as itself capable of stimulating the uterine organs. Its impression on the uterus depends solely on its influence on the alimentary canal, which it stimulates through its whole length when it is administered in doses from gr. v. to gr. xv.

2. GALBANUM. L. E. D. (p. 516.)—As an Emmenagogue, Galbanum closely resembles Assafœtida.

h. DIGITALIS. *Digitalis, folia—semina.* L. E. D. (p. 457).—The influence of Foxglove on the generative organs is undoubted. In men, it causes erections and pollutions; in women, it produces symptoms very closely resembling those which indicate the approach of menstruation; and one of the effects of an overdose is inflammation of the genital organs in both sexes. Had Foxglove not been employed as an Emmenagogue, these facts would be sufficient to authorise its administration for awakening the energy of the uterus. I have long been in the habit of ordering it in doses of from gr. i to gr. ii, combined with calomel, and followed by an aloetic cathartic on the following morning, with almost unvarying success, in suppression of the menstrual discharge. It is scarcely necessary to say that its use need not to be continued many days after the period of the monthly change, and that it is productive of the greatest benefit when it is given for two or three successive days, anterior to the time when the change should occur.

i. ERGOT OF RYE. *Ergota.* L. E.—According to Decandolle, the Ergot is a parasitic plant belonging to the natural order Fungaceæ. It grows on the ear of the rye, barley, and wheat; and, from the appearance of the ergoted grain, it is known by the name of the *Spur*. It is more common upon the rye than upon other grains, and hence the appellation Secale *cornutum*. Decandolle conceives that it is a sclerotium, and has imposed upon it the name Sclerotium *clavus*. But I am more disposed to adopt Fries' name, Spermœdia *clavus**. Fontana, Reid, Field, M. Virey, and others, think that it is not a fungus, but a disease of the grain itself, probably, as conjectured by Gen. Martin Field, from the puncture of an insect. The controversies, however, respecting its origin and nature are of little importance to our present enquiry. The diseased grain still preserves some of its characters; and it is not improbable that the change is chiefly in the conversion of the fecula of the grain

* Syst. Mycolog. ii, page 368.

into a kind of mucus; but the gluten, also, undergoes a change, and a peculiar oil and ammonia are developed, prone to putridity.

The Ergot is a nearly cylindrical, curved, striated body, of a deep violet, nearly black, colour on the exterior, and whitish within. Its length is from six to ten lines; but, in some instances, it has been found 18 and even 26 lines long; it varies from one line to three lines in diameter. When examined by a powerful microscope, the exterior coat seems to be a violet-coloured mass, sprinkled with translucent, white dots; the interior exhibits whitish-pink, brilliant grains, resembling starch; and, when divided longitudinally, it is seen to contain small, close cavities, filled with a greyish, shining powder. It is inodorous, has a mawkish, peculiar taste, and burns as if it contained oil. It imparts its colouring matter and properties to water and to alcohol. The Ergot is specifically lighter than water; whereas sound rye is heavier than water. When kept in a damp place it softens and loses its active properties, and, if in powder, it becomes in a short time covered with mites. Ergot boiled in water affords a deep claret-coloured decoction, and if the boiling be long continued, it becomes inert. When cold, the decoction throws up a fatty matter in the surface. *Liquor Potassæ* renders the decoction flaky, and throws down a light-brown precipitate; the *Carbonate of Potassa* gives a greyish-pink precipitate; *lime water*, a bluish; *protochloride of tin*, a light-yellow; *chloride of gold*, a yellow; *infusion of galls* forms a tannate of starch in it; and the *strong acids*, a yellow coagulum.

Ergot, when pressed between iron plates, yields a nearly colourless oil, with an odour similar to that of Ergot, and a slight acrid taste. Light and air deepens its colour, and heat first volatilizes it; but if the heat be continued, and the process then stopped, the oil solidifies. This oil is soluble in alcohol, ether, naptha, the volatile oils, creasote, the pure alkalies, ammonia, and also the fixed oils. Vauquelin analyzed Ergot, and procured—1. two *colouring principles*, one fawn, soluble in alcohol, the other violet, analogous to litmus, but insoluble in alcohol: 2. a *sweetish oleaginous matter*: 3. a *free acid*, probably the phosphoric: 4. *free ammonia*: 5. a *vegeto-animal matter*, strongly disposed to putridity. The last analysis is that of Dr. Wright, who states the following to be its constituents:—3·00 of a *thick white oil*, 5·50 of *osmazome*, 9·00 *mucilage*, 7·00 *gluten*, 11·40 *fungin*, 26 *fecula*, 3·4 *salts*, 3·50 *colouring matter*, and 3·50 loss, = 100·00*. Few of the usual components of the Rye, except starch and gluten, are found in it†.

* Edin. Med. and Surg. Journ. 1839. † Journ. de Chim. et Phys. t. iii.

When Ergot is eaten in rye bread, in years in which it greatly abounds, it produces a peculiar disease, somewhat similar to dry gangrene, which was known to Galen. It was epidemic in Silesia, in 1096, and again in 1588. The symptoms attending it are weakness of the lower limbs, amounting almost to paralysis, vertigo, indistinct vision; the pulse is small and weak at the wrist; there are pains in the legs and arms; and sometimes lividness in the feet and toes, which terminates in gangrene. The breathing is greatly oppressed, the bowels are but little affected, the tongue is slightly coated, and the face assumes a livid hue. Dissections of this disease have presented an unusual deposition on the adipose membrane, on the surface of the peritoneum, and dark or livid spots on the intestines, traversing the arch of the colon and descending to the sigmoid flexure and the rectum. The stomach is slightly inflamed and discoloured on the under and larger portion.

The Ergot, when taken in large doses by either sex, in the ordinary state of the habit, produces a disagreeable sensation, resembling formication in the feet, which is speedily followed by strong contraction of the muscles and spasms of the limbs, pain of the head, vertigo, delirium, and opisthotonos, or contractions of the muscles of the loins and back, which force the body into a curve backwards, so that the occiput approaches to the hips. It evidently, therefore, acts through the medium of the motor nerves, and chiefly on the extensor muscles. The question naturally arises—to what does it owe this influence over the extensor muscles? Does it contain an alkaloid resembling strychnia? Chemical examination has not authorized such a supposition. The aqueous solution or infusion is of a reddish colour, and evidently contains a free acid, which is certainly not gallic acid, but which Vauquelin supposed to be phosphoric, from its fixedness and from its action on lime water, barytic water, nitrate of silver, and acetate of lead. But no satisfactory inference can be drawn regarding the active principle of Ergot.

From Dr. Wright's experiments, however, the following inferences may be drawn:—1. The infusion or decoction of Ergot, injected into arteries or veins, affects chiefly the brain and spinal system. 2. Both of these parts may be affected at the same time, as coma and paralysis appear together; or the spinal cord may be first affected, and then the brain. 3. These results differ according to the strength of the solution: in a concentrated form, paralysis is quickly induced; in a weaker form, great excitement is first induced, and this is followed by collapse*.

* Wright's Exp. Edin. Med. and Surg. Journal, vol. iii. p. 21.

When large doses of Ergot are swallowed, the effects are those of a narcotic; convulsions also have followed its employment.

The chief use to which Ergot has hitherto been applied is to produce uterine action, to aid the efforts of parturition when these are insufficient for the expulsion of the child. For this purpose, it has been prescribed for upwards of two centuries: for Camerarius published an account of its influence in this respect in 1668; but its employment by the profession was not general until 1747. The incautious use of it had caused it to be put down by a legal enactment in France; and, although it was occasionally secretly used, it did not again attract the notice of the profession till 1807, when some cases by Dr. Stearns, of New York, again brought it forward. To aid parturition, it is administered in doses of from ℈i to ʒss, bruised and mixed in f℥ii of water, and administered at short intervals until the effect is produced. Ample experience has proved the efficacy of Ergot to expel any substance from the uterus when it is in a state of complete inactivity during the process of parturition. Now, admitting this to be true, these premises are not sufficient to authorize the conclusion that it will also aid the menstrual discharge when scanty or suppressed. Dr. Hall, an American physician, who has written on the use of the Ergot in parturition, is of opinion that it is taken into the circulating mass, and, acting as a sedative, produces a state of asphyxia in the fœtus, and such a condition of the uterus as renders it incapable of longer sustaining the child; and, therefore, this tendency in the mother brings on speedy efforts of the animal œconomy to save both mother and child. I confess that this view of the subject is quite incomprehensible to me; and the only idea I can form of the influence of Ergot, is, that it acts as a specific excitant to the parturient uterus, causing contraction in it, and consequently expelling the child. The correctness of this idea is supported by the fact that its administration has been found to be hazardous until the regular pains have ceased and a perfect relaxation has been induced. In this state, it excites again the uterine action; and from the relaxation of the resisting parts, the obstacle these present in parturition is easily overcome, and expulsion of the child is the consequence. That this is the effect of regular muscular contraction in the stimulated organ, may, also, be reasonably inferred from the feelings described by women who have taken it during labour. The sensation is not that of pain, but a constant nisus is kept up, goading, as it were, the uterus; and, during the contraction, the women describe the sensation to be "as if every thing were forcing from them."

With respect to the emmenagogue influence of Ergot, nothing favourable can be said. If the menstrual discharge arise, as I suppose, from the secreting action of the uterus, it

is easy to conceive that the cause which operates in exciting the expulsion of a child, would be likely, by operating on the muscular contractility of the uterus, to check rather than to accelerate the flow of the menses; for by constringing the vessels from the general contraction of the organ, and thereby preventing that due supply of blood which is requisite for the performance of secretion, it is evident that the secerning function of the organ would be impeded. Experience has proved that it has, indeed, very slender pretensions, if any, to the character of an Emmenagogue. This has been attributed to its transitory influence; but I am more disposed to assign it to the powerful contractions that it excites in the viscus: and on this account it has been found highly serviceable in restraining uterine hæmorrhage, both before and after delivery. It has also produced beneficial effects in cases of leucorrhœa, attended with emaciation, and a pale, blanched state of the surface, with much debility, when given in doses of gr. v to gr. x, three or four times a day. Upon the whole, I am disposed to expel the Secale cornutum from the list of Emmenagogues, although its influence upon the uterine organs in parturition is undoubted. In two cases of paraplegia, its use was followed by involuntary emissions of semen. Professor Dewes, of Pennsylvania, has laid down the following rules to be observed during its employment in parturition :—

1. It should never be given before the membranes are ruptured, the os uteri dilated, and the external parts disposed to yield.

2. It should not be used so long as the natural pains are efficient and competent to the end.

3. But should they flag from any cause, it may be given, provided the labour be a natural labour; that is, when the head, or the feet, or the breech, or the knees, are presented.

4. If flooding, syncope, or convulsions, take place, it may be employed to great advantage, if the first and second rules be not violated.

5. It is useful in every kind of premature labour; and at the full time, when the placenta is not thrown off, and the uterus is in a state of atony.

6. When floodings occur after the rupture of the membranes, if the os uteri be well dilated, and the child well situated, and the pains are feeble.

7. When the head of the child, separated from the body, has been left in the uterus.

8. When the uterus is painfully distended by coagula.

The dose of the Ergot, in the cases in which it is indicated, should not exceed thirty grains. The medicine should be preserved entire in a glass bottle with a ground stopper, and powdered only at the time it is to be given; and then it may be

administered in a glass of wine, which Dr. Balardini has found to be preferable to water. It should always be the growth of the year in which it is prescribed. The oil of Ergot displays the same action on the system as Ergot itself. Dr. Simpson, Professor of Midwifery in the University of Edinburgh, Dr. Wright, and several other practitioners, both in this country and on the Continent, have found it equally useful in a therapeutical point of view. It is also said to have been administered with advantage in Amenorrhœa; but, on the whole, neither Ergot nor its oil can be regarded as certain or efficient Emmenagogues. The dose of the oil is from m. xx to m. l. It is best given as an oleo-saccharum in water.

With reference to the therapeutical employment of this class of remedies, we may safely affirm, that, except Electricity, there is much uncertainty attending the operation of Emmenagogues. I hope the manner in which I have endeavoured to trace their modes of acting will tend to place their administration on rational principles. The importance of the regularity of the menstrual discharge in preserving the health of the female habit, is undeniable; and, therefore, every thing that can tend to maintain its periodicity, and to promote its due quantity, is of great importance in a practical point of view. In every chronic complaint of a female, it is requisite to ascertain the state of the catamenia: but, before advising any medicine for the purpose of influencing the uterus, the cause of the suppression or the irregularity must be minutely investigated. Without obtaining such a knowledge of the state of the organ, our practice must ever be uncertain: in floundering about and trying various remedies, without rule or discrimination, we may, it is true, stumble by accident upon something effectual; but much evil may be previously produced.

SECTION XVIII.

DIAPHORETICS*.—MEDICAMENTA DIAPHORETICA.

Syn. Sudorifica.

Diaphoretics are "medicines that augment perspiration." The skin, which is the organ of this function, consists of three layers; the *cuticle*, the *reticulum*, and the *corium*.

* From διαφορεώ, differo, discutio, derived from δια, through, and φερω, I carry.

1. The *Cuticle*, or exterior layer, is destitute of vessels and nerves. It nevertheless resists suppuration and even maceration for a long time, and, when destroyed, it is very quickly reproduced. It consists of horizontal lamellæ. It has no obvious pores, yet, it permits a ready passage to caloric, carbon, hydrogen, oil, acids, and watery vapour; but one anatomist, Gurlt, affirms that it is continued into the perspiratory pores. Anatomists and physiologists differ greatly with regard to the nature and formation of this portion of the skin. According to the prevailing opinion, it is a homogeneous, inorganic matter, spread in layers like a varnish over the surface, and that it is an exudation from parts beneath it, which Breschet has named blennogenous glands. Lewenhoek imagined that the cuticle contained pores: but Humboldt could detect no pores in it by means of a microscope which magnified 312,400 times: the passage, therefore, of fluids through it must be the result of simple imbibition. In man, the epidermis is constantly falling off in minute scales: but, in some instances, callosities are formed by its assuming a preternatural thickness. It is dissolved by sulphuric acid and the alkalies*. It is united to the corium or true skin by the reticulum.

The *Reticulum* is a fine mucous net-work, first noticed by Malphigi. Müller† and some other anatomists regarded it as a layer of the cuticle. Neither nerves nor vessels have been observed in the reticulum. In Europeans, it is colourless; and indeed in them its existence has been denied; but it is coloured and obvious in Negroes and in the coloured races of mankind. It appears to be the connecting medium between the cuticle and corium.

The *Corium*, or true skin, is a tough, extensible membrane, varying in thickness, formed of dense fibres crossing and interlacing one another, and through the openings or meshes of which pass capillary bodies, each consisting of the sentient extremity of a nerve surrounded by a plexus of blood-vessels. It is furnished also with numerous sebaceous follicles, which secrete and diffuse an odorous oil over the skin. In a state of health, this oil is thin and limpid: in disease, it is viscid and greasy.

The importance of perspiration for the preservation of health is well understood; but the laws which regulate it are still imperfectly determined. It is the general function of the skin; but

* When nitrate of silver is applied to it, the colour is changed, first to grey and then to black, and the salt of silver is reduced and formed into a sulphuret. It is stated by Müller (Elem. of Physiol. p. 387) that this is also the result of the long-continued internal use of nitrate of silver; but were this the case, it would scale off and disappear, which does not happen. In my opinion, it is changed into the chloride and deposited in the reticulum; whence it is not taken up and removed, owing to the insolubility of the chloride.

† Elements of Phys. p. 385, trans.

whether it is possessed by every part of it, or whether every part throws off the same quantity in a given time, has not been ascertained. It is, however, probable that some parts perspire more freely than others. The perspired matter exhales either as a thin, invisible vapour, which is termed insensible perspiration, or flows out in a liquid form, as sweat. It is thrown off from small tubes of a peculiar form, rising from minute glands, composed of convoluted vessels, seated deep in the cutis. These tubes are spiral, they open on the surface, and exhale fluid as well as the vaporous perspiration. This fluid, which is formed on the internal surface of these glands, is a thin invisible vapour, in ordinary states of the habit, and a moderate temperature of the air; but it becomes a watery fluid by exercise, hot air, and Diaphoretics. Various attempts have been made to determine the quantity of the cuticular discharge*. From the time of Sanctorius, who first endeavoured to determine it experimentally, to that of Lavoisier and Seguin, little confidence could be placed in the results of the experiments, as the amount of the pulmonary exhalation was not deducted in calculating the loss which the body sustained in a given time. Much of this difficulty was overcome by enclosing the body in a silk bag rendered impermeable to moisture by being varnished with caoutchouc, and having only one opening for breathing, the sides of which were pasted round the mouth. Lavoisier and Seguin ascertained, by this means, that the medium quantity of moisture exhaled in the form of insensible perspiration amounts to nearly eighteen grains in the minute, or three pounds, three ounces, and a hundred and sixty grains, troy, in the twenty-four hours†; and, as this was the result of repeated trials, we may regard it as the average quantity in a state of health. But the quantity is regulated by circumstances: it is also influenced by the condition of the body. Mr. Cruickshanks enclosed his hand in a glass vessel, and collected thirty grains of fluid in an hour: now, as the hand is one sixty-sixth of the surface of the body, the perspiration, at this rate, should be nearly thirty-three grains in a minute, or six pounds one ounce and two hundred and sixty grains in twenty-four hours. The hand must, therefore, either perspire more than the rest of the body, or there must be an error in the experiment. Many circumstances tend to vary the loss by perspiration, not only in different individuals, but in the same person at different times, and under a diversity of circumstances; for instance, the vigour of the frame, the nature and quantity of the ingesta, and the temperature of the atmosphere. Thus, perspiration is diminished immediately after a meal, and

* The most extensive experiments on this subject were made by Mr. Jurine, of Geneva. Hist. de la Soc. Roy. de Med. vol. x.

† Mémoires de l'Academie des Sciences, 1790, p. 610.

augmented during the process of digestion: it is promoted during sleep; in a dry state of the atmosphere; in a current of air, and under a diminished barometrical pressure. But these circumstances are supposed to promote perspiration independently of vitality; and, therefore, Mr. Edwards has divided insensible perspiration into that which results from ordinary physical influences, and that which is dependent on vitality; or, into *exhalation* and *secretion*. Both are liable to be affected by external agents. In low temperatures, the loss by exhalation exceeds that by secretion, because the cold suppresses secretion much more than it impedes evaporation. It may, indeed, be maintained that, even in low temperatures, the cutaneous capillaries are still stimulated, and consequently that the portion of the insensible perspiration which is the result of vital energy must be supplied: but it is in the ratio only of the stimulus; whilst the exhalation, which depends on physical influences, is less diminished, because the air, being heated by contact with the body, is enabled to hold more moisture in solution than the air farther removed from the body; hence evaporation is favoured. Dry air augments the cutaneous exhalation; it is also much greater than usual when the body is in a current of air; hence we feel cold in windy weather: and the same result occurs when atmospheric pressure is diminished when we ascend mountains. Mr. Edwards calculates that when the temperature does not exceed 68°, the exhalation of the skin consists of one part of the *vital* transpiration and five parts of mere *physical* exhalation, such as occurs in a dead body. The latter is simple water, the former contains animal matter in solution, carbonic acid, and nitrogen gas. The vital transpiration is a *true secretion;* hence it is checked in some diseases, although the temperature of the body is elevated. Thus, in fever, in which the influence of the cuticular nerves is depressed, the skin is burning hot, yet no perspiration flows. The evident intention of perspiration is to prevent the temperature of the body from rising above that degree which a state of health requires, and to operate as a balance to the heating influence of increased arterial action: it also counterbalances the secretions; as, for instance, that of the kidneys, which is diminished as the perspiration is increased, and augmented as it is diminished—a physiological fact of much practical value.

Many experiments have been made to ascertain the chemical nature of the perspired fluid. It is supposed that its peculiar odour depends upon exhaled hydrogen gas, variously modified by the accession of other constituents*; for instance, oily matters, an acid, and gelatin. It appears, however, rather to depend on the secretions of the mucous follicles, which probably differ in

* Experiments on Insensible Perspiration, by W. Cruickshanks.—Hist. de la Société Royale de Médecine, tome ii; and also the experiments of Abernethy, in his Surgical and Physiological Essays.

different parts of the body, mingling with the perspiration, as the excretion or fluid which they secrete is different in different parts of the body. Thus, in the armpits the odour is hircine; in the feet it resembles that of tan; in the genitals it is fœtid. This odour appears to be also, in some measure, connected with food and habit; for savages are able to distinguish the nation of persons by smelling them; and if the details of history are to be credited, we must believe that the odour of the perspiration of Catherine de Medicis was as agreeable as that of the sweetest-scented flowers; and that of our countryman, Lord Herbert of Cherbury, was equally delightful. From all that is known on the subject, we may conclude that perspiration consists of two distinct kinds of matter—*aeriform* fluids, with bases of carbon*, hydrogen, and nitrogen†; and *aqueous* fluids containing in solution some free lactic acid, lactate and phosphate of soda, and chloride of sodium; and an oleaginous principle; with a vestige of animal albumen.

Contemplating the nature of the perspiratory function, we may conclude that it is intended to answer two purposes—*first*, to convey caloric from the body, and thereby to moderate and regulate its temperature; *secondly*, to carry off a large quantity of carbon and hydrogen from the circulating mass.

There is a marked distinction between plants and animals in the importance of this function. In plants, the exhalation from their surface is very great; in some plants, more than their own weight in twenty-four hours; the whole of the superfluous nutriment taken into their systems being thrown off by perspiration. In animals, although the skin is an outlet for much superfluous matter, yet the greater part is ejected from the body by the alimentary canal, the kidneys, and the lungs. Disease is frequently the consequence of a sudden check to the perspiratory function; means, therefore, have been sought for to restore it: into the nature of these, and in what manner they produce their effects, we have now to enquire.

Diaphoretics were originally regarded as excitants, which, in every case, were supposed to be absorbed; and, by acting directly on the cutaneous capillaries, to augment the vascular action. It is reasonable to suppose that this opinion would result, from observing the effect of exercise, and the application of external heat, and that of excitant food. Experience has rectified the fallacy of this opinion, and enabled us to reason upon the operation of Diaphoretics on sounder principles. They may operate in two ways: 1st, by stimulating generally, and so augmenting

* Experiments of Count de Milly.—Histoire de l'Academie Royale des Sciences et Belles Lettres de Berlin, 1777, p. 35.

† Ingenhouz, Espériences sur les Végétaux, t. i, p. 152; Trousset, Annales de Chimie, t. xiv, p. 73.

the force of the circulation as to propel the blood forcibly through the minute or capillary vessels of the *corium*, by which both the secreting power of the skin and the excreting function of the exhalants are increased.

2ndly, by the absorption of the diaphoretic substances taken into the stomach, and the direct application of these to the cutaneous capillaries.

It is easy to conceive that, in the healthy state of the system, perspiration is always the result of stimulating, either directly or indirectly, the cutaneous exhalants; and sweating follows increased vascular action, whether this arise from muscular exertion or from substances taken into the stomach. But in disease, when the temperature of the body is elevated, and the pulse strong and frequent, the skin may remain dry. In this state, there is evidently diminished action of the exhalants, whilst the cutaneous capillaries have the secreting power impeded by over-distension, from defective organic action and nervous energy; and, therefore, this condition must be overcome before diaphoresis can be produced. When the body is in a healthy state, and the cutaneous exhalants, consequently, are neither morbidly constricted nor the capillaries relaxed from want of nervous power to maintain the current of the blood, sweating always follows increased vascular action. Those substances, therefore, which augment the force of the general circulation, whilst, at the same time, they relax the cutaneous exhalants, are, undoubtedly, the most powerful Diaphoretics. Few substances produce this double effect alone; but it is readily induced by some combinations. Thus, opium increases at first the action of the heart and arteries; ipecacuanha, by the nausea it causes, diminishes the action of the surface; the combination of both these drugs causes copious diaphoresis.

Those Diaphoretics, which operate by augmenting the force of the vascular system, increase the frequency and the power of the pulse, and raise the temperature of the body previous to the flow of perspiration: on the other hand, those which act by stimulating the cutaneous exhalants, without augmenting the force of the general circulation, exert a primary influence on the nervous energy of the stomach, and the skin responds by that inexplicable connection to which the term *sympathy* has been applied. But to produce this effect, the substances which operate as Diaphoretics must excite the capillaries only *within a certain limit;* for, if that be passed, by the action of the medicinal agent, instead of diaphoresis, its action is followed by a *dry, feverish, pungent* state of skin, and by general fever. When the diaphoretic, therefore, causes a full, strong, and frequent pulse, and an elevated temperature of the body, there is a diminished action of the cutaneous capillaries arising from over-distension and exhausted nervous energy; on which account, the secreting

function of the skin is not only diminished, but the exhalants, also, act more feebly. It is this condition of the skin, independent of the influence of Diaphoretics, which causes the distinction between the perspiratory function in health and in disease.

In many diseases, the skin loses its natural function. It loses its natural colour; it is badly nourished; it becomes dry, and is often covered with scales or crusts. In such a condition, Diaphoretics produce *neither perspiration* nor *sweating*. On the contrary, they augment tension on the surface, cause heat, and a sensation of pricking.

The action of the skin is very much modified by the condition of the nervous system. In febrile affections, when the nervous influence is depressed, the perspiration is checked; and in non-febrile states, during the influence of the depressing passions, or of syncope, the skin is covered with a *cold, clammy* sweat.

On the same principle, substances which rouse the nervous energy, and augment vascular action generally, whilst, at the same time, they aid the action of the exhalants, are the most *energetic* Diaphoretics. Thus, the compound powder of Ipecacuanha, an excellent Diaphoretic, owes its efficacy to the excitant influence of the opium on the general vascular system, whilst the Ipecacuanha, by its nauseating property, diminishes the tension of the surface: the combined action of both, as already stated, causes copious perspiration.

The primary effect of diaphoresis is the evacuation of a large portion of the aqueous part of the blood; and, therefore, it might be supposed that this vital fluid would become thicker; but various circumstances concur to prevent such a result: amongst others, thirst always accompanies sweating; and as this forces us to take fluids into the stomach, the waste of the aqueous matter thrown off by the skin is rapidly supplied. At this time, also, other fluid excretions are diminished—the urine, for instance—so that the watery matters which would be carried off by the kidneys are diverted to the surface; and even several substances, that naturally find other outlets, are expelled by the skin. This is clearly demonstrated in some diseases. Thus, in cases of ischuria renalis, or deficient action of the kidneys, the perspiration has been found to contain uric acid. Dr. Percival relates a case in which the perspired matter was so saturated with the salts of the refluent urine as to crystallize on the surface of the body in form of a white powder.

One unquestionably beneficial effect of Diaphoretics is the determination of the blood from within to the surface, thereby relieving congestions, and maintaining that due balance of the circulation which appears to be essential to the preservation of health. Their salutary influence is also displayed in the increased power of the capillaries, and in their relaxation of the surface in febrile affections. The relaxing effect of Diaphoretics is indeed

the most important property they possess as remedial agents; and on it their utility in inflammatory affections depends. Were we, however, to attempt to induce diaphoresis in inflammatory or febrile diseases by stimulating Diaphoretics, the desired effect would not only be prevented, but the hazardous symptoms would be aggravated. This fact is too seldom kept in view; and, in ordering Diaphoretics in fevers, practitioners often forget that the substances employed as such almost always increase vascular action before they produce diaphoresis. Several circumstances, therefore, are necessary to be attended to in the administration of this class of medicines in a practical point of view.

1. Whenever Diaphoretics are indicated, the patient should be confined to bed, in order to secure an equable temperature; but he should not be overloaded with bed-clothes, which also should be of a light, spongy texture. The surface, also, should be preserved from the action of cold air; and the patient cautioned not to drink cold liquids during the flowing of the perspiration. If the pulse be full, hard, and quick, and the skin hot, blood-letting, if not contra-indicated from some peculiar circumstance, should preface the use of the Diaphoretics; and the bowels, also, should be freely opened. It is a correct opinion, that free perspiration is not consonant with a quick, hard pulse, and a temperature of the skin exceeding 102° of Faht.: if sweating occur in this state, it is generally partial, and rather injurious than salutary. Even after the reduction of the phlogistic diathesis, the Diaphoretics to be selected should be those which nauseate, and relax the surface.

2. The free use of tepid diluents is necessary during the administration of Diaphoretics, unless the stomach be in a highly irritable state. If antimonial Diaphoretics, however, be employed, acidulated drinks should not be given too soon after the dose of the antimonial, as vomiting would be induced. When the temperature of the surface is high, before the sweat flows, the diluents should be cold, or nearly so; but when it is moderate, they should be tepid. So important is dilution in promoting the action of Diaphoretics, that even simple cold and tepid fluids introduced into the stomach during the hot stage of fever often produce diaphoresis.

3. During the administration of Diaphoretics, it is essential, as has been already said, to use bad conductors as coverings; both the body clothes and the bed clothes of the patient should be flannel, which, being of a light, spongy texture, not only preserves an uniform temperature, but also absorbs the moisture as the perspiration flows. When a linen shirt is worn, and the patient lies in sheets, the moisture accumulates; for linen, being a better conductor of caloric than air, carries off the heat too rapidly, condenses the vapour of perspiration, and chills the surface. Attention to this circumstance is most essential, if it be requisite

to keep up the sweating for ten or twelve hours, or longer; and especially if sleep becomes necessary during the continuance of the sweating. The older practitioners invariably resorted to the use of flannel during diaphoresis—a custom which has been too hastily reprobated by some modern physicians, as not only unnecessary, but even injurious: they recommend, instead of flannel, frequent changes of well-aired linen, asserting that this is more refreshing to the patient; that, from its comfortable feel, it has a tendency to allay irritation, and, consequently, to aid in subduing the restlessness and inquietude of fever; and that it is essential for carrying off the fomes of the disease. The last part only of this opinion is well founded, and few practitioners would place a patient, labouring under an infectious fever, in flannel; indeed, under such circumstances, perspiration, to the extent which requires the use of flannel, is neither necessary nor desirable.

4. Attention must be paid to the state of the bowels and kidneys. If perspiration be necessary in the low stage of fever, purging must be studiously avoided; and it should be checked if it occur spontaneously whilst sweat is flowing; as it is almost certain to check the sweating, and to aggravate the disease, by diverting the blood from the surface to the interior, and exposing the patient to cold. The utmost care, indeed, as already stated, must be taken to prevent the admission of cold air to the surface; and no cold liquids should be taken into the stomach whilst the sweat is flowing, and for some time after it has ceased. This is not at all at variance with the opinion which has been advanced, that sweating is excited by the introduction of cold water into the stomach in the hot stage of fever. During the administration of Diaphoretics, every thing which has a tendency to promote the secretion of the kidneys, especially cold air, should be avoided. Abstaining from frequent changes of linen is in conformity with this rule; as, in effecting these changes, the surface must be necessarily exposed, and as much drink is generally given to promote the sweating, the redundant fluids will be suddenly determined to the kidneys, and the action of the cutaneous exhalants checked.

5. The morning, directly after sleep, is the best period of the day for administering Diaphoretics, as the system is then easily excited, and the surface is more relaxed. Experience has demonstrated that many persons, in whom perspiration cannot be induced at any other period of the day, may be readily made to sweat at that time. When perspiration accompanies diseases, it generally occurs in the morning; there is then a natural decline of febrile excitement, which aids the action of Diaphoretics; hence it is the most favourable time for their operation: and, besides, as the administration of diluents is necessary to maintain the diaphoresis, this is a more convenient period for their administration.

6. When sweating is to be checked, the skin should be carefully dried with soft, warm towels, the patient should be moved into dry flannels, and the covering of his bed gradually lessened; allowing the arms to be cautiously exposed to the air. By these means the injurious consequences which a sudden revulsion might occasion are avoided.

Diaphoretics operate in two distinct modes:—1st, some excite the cutaneous capillaries and exhalants to a degree sufficient to increase both the secretory and the excretory functions of the skin beyond that point at which the perspired matter is carried off in the insensible form: hence it appears as a copious watery excretion or sweat; and the substances inducing it are distinguished from other Diaphoretics by the term Sudorifics, or promoters of sweating. 2dly, some operate in the same manner, but so moderately that they merely augment the ordinary insensible perspiration. It is true that both these results may be obtained by modifying the dose of the substances employed, and the circumstances under which they are administered; but, nevertheless, there are some substances, by which, all circumstances being equal, a more powerful effect is produced than by others. For these reasons, Diaphoretics may be arranged into—

1. *Sudorifics*,—substances causing a copious, watery, cutaneous excretion, or flow of sweat.

Sweating may be produced—1, by substances taken into the stomach;

2, by their application to the surface;

3, by violent muscular action, throwing so much blood upon the surface as to excite powerfully the secreting function of the skin, and, consequently, greatly to augment the perspiratory discharge. Exercise, therefore, may be regarded as a remedial sudorific; and it has been found of much use in dyspeptic affections, in which the skin is generally harsh and dry. It is easy to understand this effect of exercise; for, if we admit that the function of digestion may become depraved by too large a quantity of blood being thrown upon the gastric vessels, the determination to the surface, which is the result of exercise, will necessarily relieve this morbid condition of the stomach.

2. *Diaphoretics*,—substances which only augment the ordinary perspiration.

This may be induced—1, by substances which operate through the nervous system, when they are taken into the stomach;

2, by those that operate through the medium of the circulation;

3, by whatever may excite mechanically the cutaneous capillaries.

TABLE OF DIAPHORETICS.

A. SUBSTANCES WHICH OPERATE AS SUDORIFICS.

1. —when taken into the stomach.

Ponderables.

* *Organic Substances.*

a.—Emetina—procured from Cephaëlis *Ipecacuanha.*	5. 1.	Cinchonaceæ.
b.—Daphnina—obtained from Daphne *Mezereum.*	8. 1.	Thymelaceæ.
c.—Cytisina—contained in Arnica *montana.*	19. 3.	Asteraceæ.
d.—Morphia—contained in Opium, Meconate of Morphia, Acetate of Morphia, Citrate of Morphia, Tartrate of Morphia, Sulphate of Morphia, Hydrochlorate of Morphia, Nitrate of Morphia.		
e.—Guaiacum—the proper juice of Guaiacum *officinale.*	10. 1.	Zygophyllaceæ.
f.—Volatile Oils—contained in		
Roots—Aristolochia *Serpentaria.*	20. 6.	Aristolochiaceæ.
Asclepias *gigantea.*	— -	Asclepiadaceæ.
Wood—Lauras *Sassafras.*	9. 1.	Lauraceæ.
Leaves—Rhododendron *Crysanthum.*	10. 1.	Ericaceæ.

* * *Inorganic Substances.*

g.—Antimonials—

Antimonial powder?	*Pulvis Antimonialis?*
True James's powder.	——— *Jacobi vera.*
Oxy Sulphuret of Antimony.	*Antimonii Oxy Sulphuretum.*
Tartrate of Antimony and Potassa.	*Antimonii Potassio-tartras.*

2.—when applied to the surface.

Imponderables.

h.—Caloric—as contained in
Warm Air Bath,
Vapour Baths,
Warm Water Baths.

3.—by violent muscular action.

i.—Exercise.

B. SIMPLE DIAPHORETICS.

1.—which operate when taken into the stomach.

Ponderables.

* *Organic Substances.*

Animal.

a.—MUSK—a secretion of Moschus *Moschiferus.*	1. 8.	Ruminantia.

Vegetable.

b.—SOLANIA—contained in Solanum *Dulcamara.*	5. 1.	Solanaceæ.
c.—VOLATILE OIL—contained in		
Roots—Dorstenia *Contrayervâ.*	4. 1.	Urticaceæ.
Herbs—Melissa *officinalis.*	14. 1.	Labiatæ.
Rosemarinus *officinalis.*	2. 1.	———

d.—CAMPHOR.

* * *Inorganic Substances.*

e.—SALTS—

Carbonate of Ammonia.	*Ammoniæ Carbonas.*
Citrate of Ammonia.	*Ammoniæ Citras.*
——— of Potassa.	*Potassæ Citras.*
Acetate of Ammonia.	*Ammoniæ Acetas.*

f.—WATER.
Cold Water.
Tepid Water.

g.—EMPYREUMATIC OIL.

2. ——— by entering the circulation.

h.—SULPHUR.

i.—SULPHURET OF POTASSA.

k.—MERCURIALS.

Imponderables.

3. ——— applied to the surface.

l.—COLD—applied in the Cold Affusion.

m.—FRICTION.

ORGANIC SUBSTANCES WHICH OPERATE AS SUDORIFICS WHEN TAKEN INTO THE STOMACH.

a. EMETINA.—This substance, separated from Ipecacuanha (p. 739), has not yet been introduced into general practice as a diaphoretic; but, in Great Britain, Ipecacuanha, in moderate doses, is well calculated to produce sudorific effects. It is seldom administered alone for this purpose, being generally combined with opium, the narcotic influence of which it moderates. It forms the active ingredient of the Pulvis Ipecacuanhæ compositus of the Pharmacopœias. In the directions for forming this powder, equal parts of ipecacuanha root and opium are ordered to be rubbed together with eight parts of sulphate of potassa. The sulphate operates as a mechanical aid in reducing the tough opium to a fine powder, which is necessary to secure the efficacy of the compound. In the original powder of Dr. Dover, four parts of nitre and four of sulphate of potassa were deflagrated together, and one part of opium, one of ipecacuanha, and one of liquorice root powder, were rubbed up with the residue. This was an inconvenient preparation, as it attracted moisture from the air. In the present preparation, the diaphoretic influence of the ipecacuanha is augmented by the opium, whilst the soporific quality of that narcotic is diminished by the ipecacuanha. The combined influence of both, exciting the cutaneous capillaries, produces a powerful and certain sudorific effect. It may be advantageously combined with camphor or with nitrate of potassa; but it ought not to be joined with astringent substances: the Emetina, in these cases, combines with the tannic acid, and is rendered inert.

The dose of the Compound powder of Ipecacuanha is from gr. v to gr. x; but for sudorific purposes the dose should be gr. x, and it should be repeated at short intervals until the sweat appears; the patient being placed between blankets. Its sudorific effects, when once begun, should be maintained by copious dilution with tepid fluids; but these should not be taken immediately after the administration of the powder, otherwise it may be rejected by vomiting. It should also be remembered that the diluents should not be acidulated, as the combination of the vegetable acids with Emetina produces a compound, which is more likely to run off by the bowels than to act as a Diaphoretic; at the same time it is advisable to add something to the tepid water, to prevent the nausea being extended to vomiting. Lemon peel added to toast-water answers this purpose.

b. DAPHNINA.—This is the active principle of the bark of the Daphne *Mezereum,* a native of the north of Europe and of Asia, belonging to the natural order Thymalaceæ. It is cultivated as an ornamental shrub in this country. The plant has been already described (p. 796). The Daphnina is procured by digesting the bark in alcohol, filtering the tincture, and evapo-

rating to dryness; and the residue being redissolved in strong alcohol, without the aid of heat, and the filtered solution left to spontaneous evaporation, crystals of Daphnina are obtained by washing with cold alcohol, redissolving, and crystallizing. Thus prepared, it is in prisms connected in bundles, colourless, transparent, and brilliant, and very soluble in hot water. The warm aqueous solution deposites crystals on cooling: these are very soluble in alcohol and in ether. The alkalies, lime water, and barytic water, tinge the solution of a golden-yellow colour. It is not precipitated by the acetate of lead. Nitric acid converts Daphnina into oxalic acid. From these experiments, it is evident that Daphnina is a principle sui generis; but whether the medicinal properties of Mezereon are to be attributed to this substance, is not yet decided. It is combined with an acrid principle which may no doubt have some share in enabling it to act on the habit.

The bark of the root is the most active part of Mezereon; it yields its virtues to water and also to vinegar. Different chemists have analysed various parts of this plant. M. C. Gmelin and M. Royer found, in the bark, *wax;* an *acrid resin; Daphnina;* a *red colouring matter;* an *uncrystallizable* and *fermentable sugar;* an *azotised gum; ligneous fibre,* a *brown colouring matter; malic acid; malates* of *lime,* of *magnesia,* and of *potassa.* But, besides these, the bark of Mezereon contains a volatile matter, insoluble in water; and which, not being found in the decoction, is supposed to be the cause that the acrimony of the bark is much greater than that of the decoction. When this decoction is precipitated by the diacetate of lead, a portion of Daphnina is thrown down with the gum.

As a remedial agent, Mezereon operates as a stimulant Diaphoretic, exciting powerfully the heart and arteries, and determining to the surface; but it is apt to cause vomiting and purging. It has been found useful in rheumatism and in some chronic cutaneous diseases. It was long supposed to be a remedy for syphilis; but, according to Mr. Pearson's experience, it has no power of curing the venereal disease; "and I have," says he, "very seldom found it possessed of medicinal virtue, either in syphilis or in the sequelæ of that disease, in scrofula, or in cutaneous affections." Now, my experience enables me to say that this censure is too severe. I admit that the value of the remedy has been greatly overrated; but that it operates powerfully as a stimulant sudorific, is equally certain; and I have seen the decoction administered with much advantage in chronic rheumatism, and, in conjunction with the arsenical solution, in obstinate cases of lepra vulgaris. Even Mr. Pearson, in opposition to his general censure, admits that he has seen it confer temporary benefit in lepra. How far the addition of

Mezereon to the compound decoction of sarsaparilla is useful, I am not prepared to say from my own experience.

Decoction of Mezereon. *Decoctum Mezerei.* D.—Take ʒii of Mezereon bark, ʒss of bruised Liquorice root, and Oiii (old wine measure) of water; boil down to Oii, and strain. Dose f℥iv thrice a day.

c. Cytisina.—This substance was discovered by MM. Chevallier and Lassaigne*. It is of a yellow colour; is bitter, nauseous, and inodorous. Exposed to the air, it attracts moisture; it is very soluble in water, but very little in strong alcohol, and not at all in ether. Its aqueous solution is neither acid nor alkaline, nor is it precipitated by any of the metallic salts used in medicine. In doses of three grains, it operates as an emetic; and in smaller doses, as a diaphoretic.

Arnica *montana*, of which Cytisina is supposed to be the active principle, is a native of the Alps and Pyrenées, and the mountainous districts of the north of Europe. It belongs to the natural order Asteraceæ†. The whole plant, root, stem, and flowers, have a slight aromatic odour, a bitter acrid taste, and impress a sensation of pungency and heat to the throat. The powder operates as a sternutatory when it is snuffed up the nostrils. I have found that the infusion contains *Igasauric acid*, a *resin* which has the odour of the plant, *gum*, *albumen*, and some *salts*. The flowers of Arnica are the officinal parts of the plant. They may be administered in powder, in doses of six to eight grains; or in the infusion, made with six drachms of the flowers to one pint of water, of which f℥i may be given for a dose. An etherial tincture of Arnica is employed on the Continent.

Arnica, besides exerting a decided influence on the skin, through the medium of the stomach, operates especially on the spinal nerves, and also on the brain. An hour after a full dose has been taken, the patient is attacked with vertigo, cephalalgia, a sensation of formication on the skin, heats, rigors, and tetanic twitchings in the extremities, closely resembling those caused by strychnia. In large doses, it causes vomiting and gripings. The circulation is affected, the pulse quickened, the temperature of the body elevated; either sweat flows freely, or the urine is greatly augmented. From these effects, it is evident that Arnica is a stimulating sudorific: and from the twitchings, as Igasauric acid is present, I am disposed to think that it contains also *strychnia.* It is much employed in Germany in intermittents, low fevers, chronic rheumatism, and gangrene; but it is rarely prescribed in this country. It has been advantageously used

* Journ. de Pharm. June 1819.

† Hayne, iv. 46. Lindley, 465.

in various forms of paralysis, more especially that of the bladder*.

d. MORPHIA, and all its salts, particularly the *Acetate, Sulphate, Meconate,* and *Hydrochlorate,* operate as sudorifics, and augment the power of other sudorifics when combined with them. They are never prescribed alone, but generally with ipecacuanha or antimonials. They operate chiefly by their excitant influence, and therefore they are given in small doses. Much, however, depends on the constitution of the habit:—when the skin is very sensible, these salts readily promote sweating; but in the opposite state of the skin this is scarcely perceptible. It is evident that they are likely to prove beneficial in all diseases which require the aid of copious diaphoresis. They may be given in doses of gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$, repeated once in three or four hours. They are contraindicated in hectic.

e. GUAIACUM. WOOD OF GUAIACUM. *Guaiacum.* E. *Guaiaci Lignum. Guaiaci Resina.* L. D.—The first of these substances, which was for a long time, and still is, improperly regarded as a resin, is the concrete juice of a tree, the Guaiacum *officinale,* a native of the West Indies and the tropical regions of America, belonging to the natural order Zygophyllaceæ†. It is a handsome tree, clothed with bijugate leaves with obovate leaflets, and elegant, pale blue, 5-petalled flowers. Both the wood and the guaiacum are brought to Europe for medicinal use.

The *wood,* lignum vitæ, is hard, tough, and heavy, its sp. gr. being 1·333. It displays a greyish-yellow alburnum, and dark greyish-black duramen. It exhales, when heated, an aromatic odour, and, when chewed, impresses a bitter, acrid, biting sensation on the palate—qualities which it affords to water, when rasped and boiled. The Guaiacum is obtained by boring the junks of the wood longitudinally, and putting one end of them in the fire; as the heat increases, the Guaiacum exudes from the opposite end. When in a soft state, the Guaiacum is run into boxes, and thus sent to Europe: on which account, these packages contain it of every quality.

Guaiacum is in masses of a greenish-brown colour, breaking with a shining, vitreous fracture; the edges of the fragments are thin and translucent: it softens in the mouth, melts in a greater heat, and loses its green colour, which, however, it again acquires on exposure to light and air. It is heavier than water, having a sp. gr. 1·023. It is inodorous when in the mass; but when powdered or melted, it exhales an aromatic odour. Its taste resembles that of the wood, leaving a sensation of heat in the throat when it is swallowed. It is only partially soluble in

* Ann. de Med. tome iii.

† Richard, El. d'Hist. Mat. Med. ii, p. 773. Roque, 147. Hayne, xiii, 28. Lindley, 214.

boiling water; and, if filtered, affords a decoction of a green colour, which shews the presence of a salt of lime when tested with oxalate of ammonia. Alcohol readily dissolves 95 parts in 100, and offers some curious results when submitted to the action of different reagents. Thus, many recent vegetable substances—horse-raddish, the potatoe, and some other roots, if transversely sliced and dipped into the tincture—receive a colour on all the open orifices of the sap vessels which renders them visible. Milk, when agitated with it, acquires a blue colour. Sulphuric and hydrochloric acids, even in small quantity, precipitate the tincture. Chlorine changes it to a beautiful blue, which afterwards becomes brown; and with nitric acid the tincture passes successively to green, blue, and brown; even a piece of paper, soaked in it and held over the vapour of nitric acid, is tinged blue. A blue colour is communicated by sweet spirit of nitre, if recent, owing to its containing some uncombined nitrous acid; but when that spirit has been long kept, no colour is produced. The pure alkalies do not precipitate the tincture—a fact of practical utility in prescriptions.

Ether acts moderately on Guaiacum; but both the fixed and the volatile oils scarcely affect it.

Hydrochloric acid produces little action on Guaiacum; sulphuric acid, aided by gentle heat, carbonizes it; and sulphate of lime is found in the charcoal of the residue. Nitric acid is decomposed by it more rapidly than by the resins; Oxalic acid is formed, and the oxygenized Guaiacum is dissolved in the remaining acid, from which it is precipitated in its altered state by hydrochloric acid. The sulphuric acid causes no precipitate. The oxalic acid is formed in crystals when the nitric solution is left at rest. When submitted to destructive distillation, Mr. Brande procured, from a thousand grains of Guaiacum, 5·5 grains of *acid water;* 24·5 of a *brown turbid oil;* 30 of *light empyreumatic oil;* 30·5 of *charcoal;* and the remainder gases, consisting of carbonic acid and carburetted hydrogen. These results, and the effects of acids and the reagents on the tincture of Guaiacum, are sufficient to shew that it is a substance sui generis, and widely different from resin and gum-resin. Guaiacum is sometimes adulterated with Colophony; but when this is the case, it has a terebinthinate odour.

Guaiacum was employed as a remedy for syphilis so early as 1508, from observing that it was used for the same purpose by the natives of St. Domingo. But in St. Domingo the fresh and young wood was employed for making the decoction. A curious account is given of the mode of using it, by M. Louis, in his work entitled "Parallele des Traitements, &c." Two young men, Frenchmen of rank, who could not obtain a cure of a severe syphilitic affection in Europe, went to St. Domingo. They were treated in the hut of a native at Puerto Rico. The

practitioner was a female. She bruised and cut with her teeth the small branches of a young Guaiacum tree, and boiled them in an open vessel. The patients drank two pints of this decoction every morning, at two or three draughts; they were ordered then to walk out, or to exercise themselves with fencing, or else they worked in a gold mine, not far from the village, for two hours; and returning home, covered with sweat, they changed their shirts, dined, and drank only water. About three o'clock in the afternoon, they drank the same quantity of the decoction of the fresh Guaiacum wood, and performed the same exercises. They were perfectly cured in six weeks, without any inconvenience, except a swelling and an inflammation of the gums. The nodes in their bones disappeared; their nocturnal pains left them in fifteen days; and, after returning home, they remained permanently well. The decoction of the wood has been given in this country to the extent of a quart a day in secondary syphilis; but although it has been found to be a useful auxiliary in removing some of the symptoms—such, for instance, as ulceration of the tonsils and incipient nodes—yet Mr. Pearson, who is high authority upon this subject, remarks, "I have never seen one single instance in which the powers of this medicine eradicated the venereal virus*." It does not appear, however, that the same violent exercises have been pursued during its administration as in St. Domingo.

From its action on the skin, the Decoction of Guaiacum has proved serviceable in impetigo, and some other cutaneous affections—for instance, in that ulceration of the nostrils which is termed Ozena, and in scrofulous states of the membranes and ligaments. It appears to be useful in these cases from its stimulant properties, and its determination to the surface. In chronic rheumatism, attended with cold extremities, the ammoniated Tincture has been used: and when arterial action has been subdued, if it be given in large doses, of from f℥ss to f℥ii, at bed time, and its operation aided in the morning with copious dilution, in a tepid state, it seldom fails of affording relief to all the symptoms. As long as it produces only a slight or partial warmth of the body, the dose of the Tincture may be increased, even to f℥iv: but if it purge much at this dose, it should be decreased, unless the purging be accompanied with warm sweating —a thing not likely to happen. In cases of atonic gout, in which the pains wander from joint to joint, it is also prescribed with advantage: but the boasted efficacy with which its introduction as a gout medicine was proclaimed, has not been realized. Dr. Chapman, an American Professor of Materia Medica, writes thus:—"There is a morbid affection of the eye, of a gastric origin, hitherto not sufficiently noticed, where, although no ex-

* Obs. on the effects of var. art. of the Mat. Med. &c. p. 10.

ternal inflammation exists, or so slightly as hardly to be perceived, there is great intolerance of light, sometimes very acute lancinating pains through the ball; though, more generally, the sensation is that of a dull, obtuse ache, attended with much heat and aridity of surface, which, whatever may be its nature, is very successfully treated by the Guaiacum." He appeals to his own experience of the efficacy of this medicine, and affirms that he never saw the disease cured by any other. It is given in the form of the ammoniated tincture, in doses of f℈i three or four times a day. I have never seen the disease described by Professor Chapman; but it is probably connected with a scrofulous diathesis; in which case this remedy may prove useful. In administering either the decoction of the wood or the Tincture of Guaiacum, the patient must be kept in bed, if we expect to produce its sudorific effects; as, otherwise, instead of causing diaphoresis, it will excite the urinary discharge. To promote diaphoresis, Guaiacum may be given in substance, in doses of gr. x to ℈ss, made into a bolus, or it may be combined with water, by means of mucilage of gum. The decoction of the wood is a very inert preparation; and the Tincture, when given with aqueous vehicles, should be rubbed up with the mucilage to suspend the precipitate. Dr. Paris recommends a solution to be made by rubbing equal parts of quicklime and Guaiacum together, and allowing it to settle. This solution mixes with aqueous matters without decomposition.

MIXTURE OF GUAIACUM, *Mistura Guaiaci*, L. E. is made by triturating ℈iii of Guaiacum, ℈iv of Sugar, with f℥ss of Mucilage, adding gradually f℥xix of Cinnamon Water. Dose, f℥iss.

DECOCTION OF GUAIACUM. *Decoctum Guaiaci*. E.—Take of rasping of the wood of Guaiacum ℥iii, Sassafras rasped ℥i, Liquorice root bruised ℥i, Raisins ℥ii. Boil the Guaiacum and Raisins in Oviii of water down to Oi, adding the Liquorice and Sassafras towards the close; and, lastly, straining the decoction.

COMPOUND DECOCTION OF GUAIACUM, *Decoctum Guaiaci compositum*, D. is made in the same manner as the decoction of the Edinburgh College, but with ℈x only of Sassafras, ℥iiss of Liquorice root, no Raisins, and Ox (old wine measure) of water, which are ordered to be boiled down to one half. Dose, f℥ii to f℥iv.

TINCTURE OF GUAIACUM, *Tinctura Guaiaci*, L. E. D. is a simple solution of ℥vii (℥iv, D.) of Guaiacum, in Oii (f℥xxxii, D.) of rectified spirit, digested for fourteen (seven, E. D.) days and filtered. Dose, f℈i to f℈ii, rubbed up with acacia powder, to enable it to mix with water or aqueous fluids.

COMPOUND TINCTURE OF GUAIACUM, *Tinctura Guaiaci composita*, L. *Tinctura Guaiaci Ammoniata*, E. D. is made with ℥vii (℥iv, D.) and Oii (lb. iss, D.) of aromatic spirit of Ammonia, digested for seven or fourteen days, and filtered. Dose, f℈i to f℈ii.

COMPOUND LIME WATER. *Aqua Calcis composita*. D.—Take

lb. ss of Guaiacum turnings, ℥i of Liquorice root bruised; f℥ss of sassafras bark, bruised, ʒiii of Coriander seeds, Ovi, old wine measure, of Lime water; macerate, without heat, for two days, with occasional agitation, and then strain. Dose, f℥ii to f℥iv.

f. VOLATILE OILS.

These, in a separate state, are too stimulant to be employed as Sudorifics, except in diseases of a diminished excitement.

1. SERPENTARIA-ROOT. *Serpentariæ Radix.* L. E. D. (p. 37).—When the skin is hot and dry, and requires the employment of a Sudorific, and yet the relaxing Diaphoretics cannot be employed, Serpentaria is one of the best of the stimulant Sudorifics; its activity depends on volatile oil and resin; and on that account the form of tincture is preferable to that of infusion. It has been found useful in dyspeptic affections accompanied with a dry skin; and forms an excellent addition to the Cinchona bark, or the salts of Quina or Cinchonia in protracted cases of intermittents, and in atonic gout. The dose of the Tincture of the Pharmacopœias is from fʒss to ʒii, in any light, bitter infusion or decoction.

2. MUDAR. *Asclepiadis giganteæ Radicis Cortex.*—The species of Asclepias, or rather Calotropis *gigantea**, (R. Brown), yielding this bark is a native of Bengal, belonging, as its name implies, to the natural order Asclepiadaceæ. The root, which is the active part, is long, branching, woody, and covered with thick, lactescent bark. In preparing it for medicinal use, the root is dug up in April and May, well washed, and allowed to dry in the air, so as to inspissate the proper juice. The cuticle is then scraped, the root decorticated, and the bark dried. The bark is of a dull, whitish-fawn colour, smooth on one surface, and slightly corrugated on the other; its taste is rank and nauseous; its odour like that of pease-meal. Its activity is said to depend on a peculiar principle named *mudarine*, which coagulates by heat, and becomes fluid again when cold†.

The Mudar has been long employed by the native practitioners of India, in syphilis‡, lepra, elephantiasis, rheumatism, and many other diseases. It is a powerful stimulant sudorific, exciting the cutaneous capillaries, and diminishing the velocity of the general circulation. Its influence on the glandular system is also well ascertained: in many respects it resembles that of mercury. It proves most beneficial in low states of the habit, indicated by pallidness, emaciation, disordered digestion, and imperfect assimilation: in the opposite condition of the body, it

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* Rumph. herb. Amb. auct. 24. Lindley, 540.

† Wight's Contrib. to Ind. Bot.

‡ Mr. Twining, of the Bengal Medical Service, affirms "that it has an especial power of promoting the exfoliation of diseased bones."

proves decidedly injurious. During its use, the diet should be vegetable; wine and every stimulant being carefully avoided. In large doses, it produces much constitutional disturbance, especially on the brain and nervous system, and nausea. It may be given in the form of powder, in doses of gr. iii to gr. x, repeated every second or third hour. In doses exceeding ten grains, it operates on the kidneys. In India, the native doctors apply it externally as a suppurative.

3. SASSAFRAS. *Sassafras*. L. E. *Laurus Sassafras*. D.—Sassafras is the wood of a small tree, Laurus Sassafras, a native of North America and Brazil, belonging to the natural order Lauraceæ*. The root, as well as the flowers, are officinal. It is a stimulant Sudorific when the surface of the body is kept warm during its administration. Experience has confirmed its efficacy in gout and rheumatism. If it do not produce sweating, it causes febrile excitement; and this generally occurs in plethoric persons of a dry, bilious temperament. The influence of this Diaphoretic on the cutaneous capillaries has suggested its employment in skin diseases; but when these are of an inflammatory description, it ought not to be prescribed. It is usually taken in the form of infusion, made with half an ounce of the chips and two pints of water. The volatile oil being its active principle, decoction is a bad form of preparation.

Sassafras is now rarely employed, except as an ingredient in the compound decoction of Sarsaparilla.

OIL OF SASSAFRAS, *Oleum Sassafras*, L. E. D. is obtained by distilling the wood with water. It is a nearly colourless oil, of a density 1·094; therefore it sinks in water. It becomes coloured yellow by use, has a penetrating odour, and an acrid aromatic taste. It gradually deposites crystals of stearoptin when exposed to the air. This oil, as an oleo-saccharum, would be a more certain method of communicating the influence of Sassafras than any other preparation: it might be given in doses of from m. iii to m. vi.

4. THE LEAVES OF RHODODENDRON.—The leaves of the Golden-flowered Rhododendron, Rododendron *crysanthum*†, although highly prized as a sudorific in Russia, where it is indigenous, has disappointed the hopes of practitioners in this country. In Siberia, a weak infusion of these leaves is used daily as a tea: in a stronger decoction, it produces effects not unlike those of intoxication; and has consequently been called *Intoxicating Tea* in Russia. To produce its diaphoretic effect, the Siberians infuse ʒii in f℥xii of boiling water for a night, in a warm place. The whole of this infusion is taken in the morning upon an empty stomach: it soon nauseates, and excites per-

* Hayne, xii, 19. Lindley, 338.
† Pallas Fl. Rossica, i, 44, t. 30. Lindley, 378.

spiration; and, while this continues, food is proscribed. After some hours, it produces a copious, black, fœtid stool; and, if the disease be rheumatism, the patient rises free from pain. Dr. Halliday, of Moscow, in a letter to Dr. Paris, says that the severest fits of gout are cured by repeating the medicine for three successive days. In large doses, besides nausea, it causes vomiting, delirium, and all the other symptoms of intoxication; and, when these subside, a proportional diminution of excitement takes place. The plant has been brought to this country and submitted to trials, both in gout and rheumatism; but it has disappointed the hopes of those who have prescribed it. Whether this is owing to its suffering from drying or exportation, or owing to the constitution of the patients being different from those in Russia, I will not pretend to determine.

* * *Inorganic Substances.*

g. ANTIMONIAL PREPARATIONS.

1. Antimonial Powder. *Antimonii Pulvis compositus.* L. *Pulvis Antimonialis.* E. D.—This powder is a compound of oxide of antimony, antimonious acid, and phosphate of lime. According to the London and Dublin Pharmacopœias, it is formed by burning together one part of sulphuret of antimony and two parts of shavings of hartshorn. When brought to a white heat, by projecting the mixture into a red-hot crucible, and stirring until vapours cease to rise, the sulphur is completely expelled, the gelatin of the shavings is burnt, and the sesquioxide, absorbing more oxygen, passes into antimonious acid; whilst antimoniate of lime is also produced. It is an inodorous, insipid, dull white powder, insoluble in water, and scarcely soluble in acids.

The utmost diversity of opinion exists respecting the utility of this preparation, many practitioners contending that it is perfectly inert, others asserting "that it is one of the best Antimonials which we possess*." From the results of its administration in my practice, I cannot place any confidence in its diaphoretic powers. In general, it displays no influence whatever on the system. It has been given in doses of sixty†, eighty, and one hundred and twenty grains‡, without any sensible effect. Its occasional activity may be ascribed to the oxide being accidentally in the state of a protoxide.

2. James's Powder. *Pulvis Jacobi.*—The celebrity of the powder of Dr. James, as a certain diaphoretic, has led to many unsuccessful attempts to imitate it: and the antimonial powder of the Pharmacopœias was intended as a substitute for this

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* London Med. Gazette, December 1831. † Mr. Hawkins gave that dose.
‡ Dr. Elliotson found that dose nearly inert.

empirical remedy. According to the analysis of James's powder by the late Dr. Pearson*, 100 grains contain 57 grains of peroxide of antimony (antimonious acid), and 43 of phosphate of lime: according to the analysis of Mr. Phillips†, the proportions are 56 grains of the antimonious acid, 42·2 of the phosphate, and 1·8 of sesqui-oxide of antimony. But were these analyses correct, this powder would prove as inert as its imitation; for the antimonious acid produces no effect on the living system. A specimen of Butler's James's Powder, examined by me, contained ten per cent. of the sesqui-oxide; a result which nearly accords with Dr. Maclagan's analysis. He found 2·89 in Newberry's, and 9·80 in Butler's James's Powder. It is to the sesqui-oxide of antimony that its diaphoretic influence is due. Signor Pully‡, an Italian chemist, affirms that it consists of 7 parts of *protoxide of antimony*, + 4 of *phosphate of lime*, + 3·5 of *sulphate of potassa* and *hypo-antimonite of potassa*, intimately combined with *peroxide of antimony*. It has been affirmed that this powder is as inconstant in its operation as the antimonial powders§; but I have not found it so: much of its irregularity of action may be ascribed to the condition of the habit at the time of its administration. The dose is gr. v to gr. x.

3. Oxy-Sulphuret of Antimony. *Antimonii Oxy-Sulphuretum.* L. *Antimonii Sulphuretum aureum.* E. Brown Antimoniated Sulphur. *Sulphur Antimoniatum fuscum.* D.—The dose of this preparation (p. 748), as a diaphoretic, has been much understated. It may be given to the extent of gr. x, in combination with calomel and opium: but it is uncertain in its operation; and is seldom employed, except as an ingredient in the compound calomel pill of the London Pharmacopœia.

4. Tartrate of Antimony and Potassa. *Antimonii Potassio-Tartras.* L. *Antimonium Tartarizatum.* E. *Tartarum Emeticum.* D. (p. 749.)—This is the most certain of the antimonial diaphoretics. In doses of one sixth to one fourth of a grain, in combination with calomel and opium, frequently repeated, it rarely fails to produce copious diaphoresis. This effect might, indeed, be anticipated, from the greater solubility of tartar emetic than any of the other antimonials. Next to this is James's powder: all the others are uncertain in their effects. No medicines are so much modified in their action by idiosyncracy as antimonials: in one person, small doses of tartar emetic will induce only moderate sweating; in another, the same dose will cause alarming vomiting and purging, and extreme depression, both of bodily strength and mental energy. In prescribing tartar emetic, it should be recollected that it is

* Phil. Trans. 1791, p. 317. † Ann. Phil New Series, vi, 187.
‡ Ann de Chim. tome lv. p. 74.
§ Dr. D. Munro, Treat. on Med. and Pharm. Chem. i, 367.

decomposed by the alkaline carbonates, the medicinal soluble salts of the oxides of zinc, lead, bismuth, and mercury; and that an insoluble tannate is formed with the protoxide of the tartrate, when it is added to the astringent vegetable infusions and decoctions, with the exception of those of oak bark. The tannate thus formed is inert; on which account, the decoction of yellow Cinchona bark is the antidote of tartar emetic when it is overdosed.

In acute rheumatism, I know nothing that proves more serviceable than a combination of one grain of calomel, a quarter of a grain to a grain of emetic tartar, and from one grain to two grains of opium. Some authors recommend the Tartrate of Antimony and Potassa to be compounded with prepared chalk: but this preparation is apt to run off by the bowels, instead of causing diaphoresis. Upon the whole, when the intention is to determine to the surface, the Tartrate of Antimony and Potassa, given in proper doses, frequently administered, is more manageable than any other of this class of remedial agents. When it is given in large doses, it subdues inflammatory action without inducing nausea or vomiting, after the first or the second dose; or even exciting diaphoresis. As this mode of employing tartar emetic has excited much attention, some account of it may not be deemed unprofitable. If three, four, or six grains of this salt, dissolved in a glassful of water, be taken for a dose, one or two vomitings, and sometimes one or two alvine evacuations, follow: but if the same quantity be repeated two or three hours afterwards, neither vomiting nor purging will ensue; nor will they occur even if the dose be augmented to half a drachm or more, and its use continued for several successive days: under these circumstances, no other inconvenience except thirst is experienced. There are, nevertheless, exceptions to this rule; and, occasionally, inflammation and ulceration of the pharynx, the œsophagus, and stomach, supervene. The pulse is lowered in a remarkable manner, and reduced in frequency: and sometimes the most copious sweating is induced. The administration of large doses of tartar emetic was suggested by Dr. Rassori*, an Italian physician, who also taught that inflammation operates as a protecting power against the influence of tartar emetic, and that the degree of morbid excitement may even be determined by the extent to which the dose can be carried with impunity: an opinion which is purely hypothetical: the apparent impunity depending on the subacute inflammation set up on the mucous membrane, preventing the absorption of the salt; and the same effects result in health as in inflammmatory diseases. The utility of this mode of administering tartar emetic in restraining inflammatory action is undoubted; but the diaphoretic influence of the

Bayle's Bibliothéq. de Thérap. i, p. 198.

medicine is most certainly secured when it is given in small doses, frequently administered.

Tartar Emetic is undoubtedly the best and most certain of Diaphoretics; and when cerebral symptoms are present, it is essentially useful in reducing these, when the dose is sufficiently small to insure its diaphoretic effect without inducing vomiting; namely, from one twelfth to a quarter of a grain, repeated every third or fourth hour.

Antimonial Wine. *Vinum Antimonii Potassio-Tartratis.* L. *Vinum Antimoniale.* E. — Dissolve ℈ii of Potassio-tartrate of Antimony in Oi of Sherry wine.

Solution of Tartar Emetic. *Liquor Tartari emetici.* D. —Take of Tartrate of Antimony and Potassa, ℈i; boiling distilled water, f℥viii; Rectified Spirit of Wine, f℥ii: dissolve the salt in the water, filter, and add the spirit.

The first of these preparations is the best; but the sherry should be pure and free from acidity, as a precipitate of the oxide of antimony is likely to result when that is not the case. Each fluid ounce contains two grains of potassio-tartrate of antimony.

2. SUBSTANCES WHICH OPERATE AS DIAPHORETICS WHEN APPLIED TO THE SURFACE.

h. BATHS

The stimulant influence of caloric upon the living habit is well ascertained: it operates powerfully upon the cutaneous exhalants, and causes diaphoresis in whatever manner it is applied, within certain limits. As I formerly stated, it may be applied through three media—*air, aqueous vapour,* and *water.*

1. Warm Air Bath. — This bath consists of air, the temperature of which is artificially raised above that of the body in a state of health. Warm air chambers were used as luxuries by the ancient Romans: and, as a medicinal agent, the Warm Air Bath was employed by the older physicians*. In air at 90° to 100°, copious perspiration is excited; at 130°, the surface is powerfully stimulated, but sweating does not always follow; at 150°, a sensation of smarting is experienced in some parts of the body, especially the eyes and nose, and, in females, in the nipples; the general surface feels pungently hot; the superficial veins are dilated; the urine is lessened in quantity; and it is not until after a short time that a copious sweat breaks out over the whole body. If the latter effect do not take place, the pulse beats strongly, increases in rapidity, sometimes beating 160 in a minute, and headache and vertigo supervene. A *Sudatorium,* or hot air bath, was suggested by the late Dr. Gower†, in 1819,

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* Hoffmani Opera Omnia, t. i, p. 465. † Auxiliaries to Medicine, 8vo. London.

when physician to the Middlesex Hospital. His apparatus consisted of a wicker, oblong arch or cradle, which was placed over the patient and covered with blankets. At the end of this frame, and under the covering, a metallic tube was fixed, which opened over a lamp, and rose as a kind of chimney to convey the air heated by the lamp to the space surrounding the patient. At the temperature of 85° to 90°, air applied in this manner causes profuse sweating; it is not stimulating to the surface, and has a soothing effect on the nervous system; and it is more certainly productive of sweating than either the warm-water bath or the vapour bath. It has been found serviceable—1, in chronic rheumatism, and other painful affections of the joints; in rigidities of the limbs: 2, in psoriasis and some other scaly eruptions: 3, in congestive fevers, in which the powers of the habit are unequal to restore the balance of the circulation; indicated by a cold clammy state of the skin; a feeble pulse; the breathing hurried; the countenance anxious and livid; and the whole corporeal energies oppressed. It is peculiarly indicated, also, in the state of collapse attending Indian cholera: but, in many of the cases in which it was used in that disease, the temperature was elevated to a degree which, in the depressed state of the vital powers, was productive of the most injurious, and, in some instances, fatal consequences.

Various vapours, such as that of sulphurous acid, chlorine gas, and the vapour of Iodine, have been added to the Warm Air Bath; but its diaphoretic powers are not augmented by these additions; and it is generally necessary to throw in watery vapour after the application of these gases and medicinal vapours, which altogether alters the character of the bath.

2. THE VAPOUR BATH. *Balneum Vaporis.*

When, instead of air, aqueous vapour is employed as the vehicle of caloric, the effects are somewhat different from those arising from the air bath.

In Russia, the Vapour Baths are steam chambers or stoves; they are fitted with benches rising above one another; and the vapour is produced by throwing water on stones heated to redness by a furnace underneath. The vapour at the bottom of the room is 112°, at the top it is 180°. The bathers sit at first on the lower benches, and gradually ascend to the higher. The relaxation induced by this Vapour Bath is greater than that experienced in the water bath. This is perhaps due to the degree of stimulus caused by vapour being less than that produced by water of the same temperature, whilst the relaxant property is equal; and, therefore, as the relaxant power is not counteracted by an opposing influence, the necessary consequence is the increase of effect. When vapour is used, also, it is applied to the

interior of the thorax, at least to the air tubes, as well as to the surface of the body; and something may be thus effected by a greater extension of surface. In Egypt and Persia, as well as in Russia, the vapour bath is employed as an article of luxury, accompanied with *shampooing* or *massing*, which consists in rapid friction and kneading of the limbs, with extension of the muscles and tendons: the hand of the operator being smeared with medicated oil.

The Vapour Bath is employed in this country only medicinally, and is of a more limited character; in general, the head is not enclosed in the bath, so that the patient does not breathe the warm vapour, although he may do so at his pleasure. Vapour at 106° to 120°, if not breathed, is equal in its influence on the body to water at 92° to 68°; but when the vapour is breathed, 110° is equivalent to the highest degree of the warm water bath, namely 98° to 106°. At these temperatures, the Vapour Bath is a more powerful derivative than the warm water bath, and consequently it is more certainly diaphoretic; whilst, at the same time, it is less soothing and tranquillizing. This form of bath is peculiarly serviceable in the early stage of catarrhal affections, especially if the vapour be breathed, so as to be applied to the mucous membrane. The temperature should not exceed 106°; indeed, in every case, if the perspiration can be obtained at a low temperature, the more is it likely to prove salutary.

3. WARM WATER BATH.

Under this name are comprehended two varieties of water baths:

a. The Tepid Bath.
b. The Warm Bath.

a. The Tepid Bath, *Balneum tepidum*, — consists of water of a temperature from 86° to 92°. At 86°, water scarcely feels warm, and certainly exerts no stimulant influence on the skin, and is rather to be regarded as a refrigerant than as a Diaphoretic; at 92° the warmth is agreeable, and the effects on the habit are soothing. It is useful in dry and irritable conditions of the skin, accompanying febrile affections; and many individuals, from idiosyncracy, who cannot tolerate the warm bath, derive much advantage from the employment of the Tepid Bath. In such persons it excites diaphoresis; but, in general, this is not the result of its employment. It has been found most salutary in convalescence from acute diseases, when brisk exercise can be taken after it.

b. The Warm Bath. *Balneum calidum mitius.* — The temperature of this bath is between 92° and 98° Faht. It excites an agreeable sensation of warmth. It is applicable to

almost every purpose for which warm-bathing is indicated, with the exception of a few cases which demand the use of the hot bath. Its excitant powers on the cutaneous capillaries is sufficient to cause perspiration, whilst, at the same time, they soothe the nervous and vascular systems. It may be said rather to solicit than to impel the blood to the surface: it allays irritation, resolves spasm, relieves pain, and displays a secondary sedative influence, relaxing whilst its primary effect is stimulant and directly Diaphoretic.

The Warm-water Bath was employed for medicinal purposes, and indulged in as a luxury, in the earliest ages of society. As an article of luxury, we read of its use in the book of Genesis, in the works of Herodotus and Zenophon, and in those of all writers who have transmitted accounts of the customs of the Asiatic nations. In the Odyssey, we find that it was used by the Greeks at a very early period of their history. It is probable that they received their knowledge of it from the Egyptians; and it is undoubted that the Greeks transmitted it to the Romans. With that luxurious people the use of warm baths was carried to the highest pitch.

In curing diseases, the warm bath has also been employed from the earliest times. It produces various effects on the living body; but these differ according to the temperature of the water. The first action of the Warm-water Bath is on the nervous system; the fluid impresses an agreeable and soothing feeling to the skin, uneasy and irritable sensations are abated, and a tranquil and pleasing languor steals upon the senses. According to the degree of temperature, the action of the heart and arteries is increased; but, after a time, the pulse softens, and perspiration breaks out. The ultimate effect is the relaxation of the surface—a result of the warm bath which seems to depend on the combined influence of the caloric and the water; for it is produced by neither alone. In examining the effects of the Warm Bath, they appear to operate on two principles:—1. They act upon the body nearly in the same manner as upon other masses of matter: 2. They operate upon it, as it is endowed with vitality. The second mode of operating is that which chiefly interests us. Looking at the Warm Bath in this point of view, we find that it stimulates gently the sensibility of the body. The influence of heated water, as an excitant, is felt before its diaphoretic effects are displayed, and in the direct ratio of the temperature employed. In the Warm Bath, at 98°, the sensation is agreeable; it is almost intolerable in the hot bath at 106°. This appears, at first view, inexplicable, when we reflect upon the high temperature which the body can bear in hot air: and we are inclined to enquire why the sensation of heat is so much greater when caloric is introduced by the medium of water? Various circumstances contribute to produce this effect: water is a better conductor of caloric than air;—in

the bath, the surface does not exhale, which is a cooling process; and the aërial perspired matter probably forms a warm atmosphere around the body.

Besides the sensibility, the warm bath affects, also, the irritability of the system: the pulse is moderately quickened; it is also rendered fuller than before; but after a short time this effect is modified by the condition of the body. In health, the pulse is at first accelerated; but, according to the series of experiments made by Marker in a bath between 87° and 97°, the morbid velocity of the pulse in fever is diminished; in both cases it becomes slower in proportion to the length of time the person remains in the bath. This effect also varies in different persons. Now, although the ultimate result of the Warm Bath be the reduction of the velocity of the pulse, yet, in general, its first impression is to increase it. The Warm Bath, indeed, in this respect, agrees with all other stimulants: it first excites, and ultimately produces a state the opposite of excitement. Nor are these effects different, with the exception of the degree, from those of the hot bath between 100° and 106°: in the hot bath at 106°, the velocity of the pulse continues increased after the patient has been twenty minutes in the bath; the arteries beat violently to the ends of the fingers, even after immersion for half an hour: the breathing becomes laborious, the vessels acquire turgidity, and the surface is red; but, after three quarters of an hour, sweat bursts forth; and, in fifteen minutes after coming out of the bath, the pulse and the heat become natural, and much languor is experienced. The effects of the Warm and Hot Baths differ in this respect—the former is relaxant and diaphoretic; the latter, stimulant and sudorific. In the Warm Bath, the lessened tension of the skin diminishes the tension of the whole frame; hence, the phlogistic diathesis is relieved: but the sudorific effect of the hot bath depends on its powerful stimulant properties. The Warm Bath is better calculated to stimulate the capillaries to that extent which favours diaphoresis than the hot bath; its salutary effect is the result of its derivative, relaxant, and diaphoretic powers.

As a therapeutical agent, our attention in the present instance must be confined to the diaphoretic influence of this bath. In acute inflammatory affections it is always serviceable, provided blood be previously abstracted; and this is especially necessary when the inflammation is accompanied with pain and spasm. In chronic inflammations, the same prefatory measure is demanded; but as, in these, the determination of blood is usually confined to some particular organ, local bleeding is preferable to general bleeding, previously to the use of the Warm Bath. The irritable state of the stomach and mucous membrane of the alimentary canal, the dry and unhealthy condition of the skin, and the cold extremities, strongly indicate the

employment of the Warm Bath in dyspeptic affections. Besides equalizing the circulation, its influence on the nervous system tranquillizes the hypochondriacal feelings usually attendant on dyspepsia: it is always a safe, generally a most salutary, remedy; and to these effects we may ascribe the advantages which follow its employment in the intervals of gout and rheumatism, in conjunction with friction and percussion. In febrile affections, it is found to prove beneficial in the cold stage of intermittents, chiefly on account of its derivative influence; and it is still more useful when there is much nervous irritation present. But some caution is required in plethoric states of the habit: this condition should always be removed by the employment of the lancet before resorting to the use of the Warm Bath.

Notwithstanding the apparent simplicity of the application of the Warm Bath, there is no remedy so frequently abused: hence the necessity for rules to regulate its use; and these are applicable to every form of the bath, whether air, vapour, or water be employed.

1. In persons of plethoric, apoplectic, or hæmorrhagic habits, or where there exists organic disease of the heart, the utmost caution is requisite in the employment of the Warm Bath, unless previous depletion has been resorted to; and, even after this, the temperature of the bath should not exceed 96°, and its equivalents if air or vapour be used. Equal precaution is necessary during the presence of the catamenia, and in the latter months of pregnancy. Warm bathing is altogether contraindicated in great debility and relaxation of the system, and even when the nature of the disease indicates its utility; yet, if the individual case afford an instance of any of those conditions to which we have just referred as requiring caution, the nature of the attack does not alter the necessity for caution in its employment.

2. When the use of the bath is determined upon, the degree of temperature must be regulated by the particular nature of the case and the condition of the habit of the patient. If diaphoresis be our object, the heat of the bath should not exceed 98°; but many persons find a lower temperature more agreeable and soothing; and this predilection should not be counteracted. The temperature of the bath should be sustained at the same degree as long as the patient remains in it. The time for remaining in the bath must be determined by circumstances: if much relaxation be desirable, the time should be considerable; and, if the disease be of a chronic character, or if it be cutaneous, the period may be extended to two or more hours. In acute diseases, the bath must be employed at the time in which its influence is required: in chronic diseases, however, when much diaphoresis is required, it should be used in the evening,

and the patient should sleep in blankets; but when this is not the object, it may be taken in the forenoon, about two hours after breakfast; so that the patient may exercise himself in the open air after it, between the time of using it and dinner; although an unnecessary exposure to the air, if the weather be cold or damp, must be avoided.

3. At whatever time of the day the bath is used, it should not be too often repeated, except in cases of spasm and severe pain, in which its relaxant and anodyne, rather than its diaphoretic, influence is required.

4. In delicate habits, a warm sea or salt-water bath is preferable to one of simple warm water, not only because it is less relaxing and there is less risk from exposure after its use, but because it is more derivative, and the stimulant influence of the saline matter on the skin continues after coming out of the bath. The nature of the saline impregnation modifies the action of the bath; hence, the various thermal springs differ in their effects, and sea water differs from all of them.

5. In employing the Warm Bath as a Diaphoretic, friction should always be used in the bath; and warm diluents with flannel clothing when the patient is taken out of it. Among the ancients, the bathers were anointed with oil and other unguents on emerging from the bath; and thus, by preventing too copious perspiration, the body was slowly cooled. Indeed, in all the ancient authors who mention baths, we find that the *Unguentarius* was the principal officer attached to the bath; and in this respect we should do well to imitate our forefathers.

3. DIAPHORESIS FROM VIOLENT MUSCULAR ACTION.

Violent exercise produces that vascular action which is the exciting cause of positive sweating under states of the body unaccompanied by a morbid constriction of the cutaneous exhalants. It can scarcely, however, be regarded as a therapeutical agent; but it is wrong to assert that muscular action has never been employed as a remedy; for, although it has not been prescribed by the physician, yet it has been employed frequently by the vulgar, and with decided advantage. Paroxysms of ague have been shortened by bringing on the perspiratory stage by running, immediately the cold fit was found to be approaching; and I have more than once seen acute rheumatism cured by taking a long and fatiguing walk. It is true that this remedy, in either disease, can be employed only by the man of determination and courage, whose energy of mind rises superior to his corporeal sufferings. In the one case, namely, the paroxysm of ague, the sensation of indolence and weariness, and the bruised feeling which is extended over the whole body, with the confusion of ideas and the irksomeness of the attempt to bend the attention,

for any time, to one object, unnerves even the strongest man and unfits him for exertion; whilst, in the other, acute rheumatism, the sense of pain appears almost to be sufficient to prevent walking, even in the stoutest-hearted individuals; yet persons occasionally appear who are capable of overcoming these difficulties, and have found their advantage in the boldness of their resolution. In one disease, however, in which humanity in all its pride is humbled—Insanity—exercise, in the manner necessary to produce a sudorific effect, is often successfully employed as a remedy. In this case it performs what powerful stimulants effect in some other diseases: it diffuses the blood over the system, and tends to restore that balance of the circulation which is always disturbed in this greatest of maladies.

B. SIMPLE DIAPHORETICS.

1. SUBSTANCES WHICH AUGMENT THE ORDINARY PERSPIRATORY FUNCTION WHEN TAKEN INTO THE STOMACH.

* *Organic Products.*

Animal.

a. MUSK. *Moschus.* L. E. D. (p. 510).—The diaphoretic powers of Musk are feeble; and, therefore, it is rarely prescribed as a Diaphoretic in this country.

Vegetable.

b. SOLANIA.—This is the active principle of the Solanum *Dulcamara**. Solania is a white, inodorous, opaque powder, of a slightly bitter taste, and displaying the characters of an alkaloid. It is insoluble in cold water, and requires eight thousand times its weight of hot water for its solution; but it is soluble in alcohol, in ether, and in acids. With acids it unites and forms uncrystallizable neutral salts, which have a bitter taste. It is procured by precipitating the expressed juice of Bitter-sweet with ammonia, collecting the precipitate, drying it, and treating it with boiling alcohol. This menstruum takes up the Solania and deposites it on cooling†. In Bitter-sweet it is combined with malic acid, and with a sweetish, bitter extract, named *Picroglycion*, discovered by Pfaff‡.

BITTER-SWEET. *Dulcamara.* L. E. D. *Salanum Dulcamara.* D.—Solania has not yet been employed in medicine; but Dulcamara is in common use as a Diaphoretic. It is indigenous, and common all over Europe, Asia, and America, flowering in

* Woodville's Med. Bot. third edit. p. 240, pl. 85. London Dispensatory, art. Solanum. Richard, Hist. Nat. Med. tome ii, page 95. Lindley, 511.

† Journ. de Pharm. t. vi, p. 374, and t. vii, p 414.

‡ Solania is an energetic poison: two grains killed a rabbit, with symptoms of coma and paralysis; and large doses caused vomiting and drowsiness in dogs.

June and July. Dulcamara belongs to the natural order Solanaceæ; it is a slender, branched, twining plant, rising, when supported, to eight or ten feet in height. The lower leaves are cordate, acute; the upper usually hastate; both smooth, and entire at the margin. The flowers are in drooping, spreading, cymose clusters, with minute bracts; the segments of the petal purple, with two green spots at the base of each segment. The fruit is an oval, juicy, scarlet berry. The twigs, collected in the autumn, are the parts employed. They are unpleasantly odorous, when recent, but the odour is lost in drying; their taste is somewhat acrid, bitter, and sweet. According to Pfaff, they contain 21·817 per cent. of *picroglycion*, 3·125 *vegeto-animal matter*, 12·029 *gummy extractive*, 1·4 *gluten and green wax*, 2·74 *resin* with *benzoic acid*, 2·0 *extractive, starch, and sulphate of lime*, 4·0 *acetate and phosphate of lime with extractive*, and 62·0 *lignin*. The decoction of the twigs has been advantageously given in lepra and some other cutaneous diseases, in conjunction with arsenic, or with bichloride of mercury. It frequently excites nausea at first; and on this, probably, the diaphoretic powers of the plant, in some degree, depend. If its use be continued for some time, the strength of the decoction should be gradually augmented. It precipitates sulphate of iron, nitrate of silver, and the acetates of lead; which, therefore, cannot be prescribed with it; but it produces no effect on the bichloride of mercury, tartar-emetic, lime water, nor the alkalies.

Decoction of Dulcamara. *Decoctum Dulcamaræ*. L. E. D. —Take of chopped Dulcamara ℥i, Water f℥xxiv, mix and boil down to f℥xvi, and strain.

Although the decoction excites nausea and vomiting, it can scarcely be regarded as capable of acting as a virulent poison. In large doses, however, it operates as a narcotic, causing vertigo, dilatation of the pupils, slow and intermittent pulse, and trembling of the limbs; but no instance of death from its influence is recorded. The best antidote is the carbonate of potassa. It has been chiefly used in cutaneous diseases. The dose is f℥i to f℥ii, three times a day.

c. COMBINED VOLATILE OIL.

1. Contrajerva Root. *Contrajerva*. L.—The Dorstenia *Contrajerva** is a native of Peru, Mexico, and the West Indies, belonging to the natural order Urticaceæ. The roots, which are the parts employed, are attached to an ovoid, tapering rhizome, compact and rugose, with numerous fibres: externally of a brownish colour, internally whitish. The odour of the dried root is peculiar, somewhat aromatic; the taste warm, bitterish,

* Woodville's Med. Bot. third edition, p. 705, pl. 240. London Dispensatory, art. Dorstenia. Richard, Hist. Nat. Med. t. i, p. 553. Nees von Essen. 98.

and astringent. It is generally administered in the form of powder, in doses of gr. v to ℈i; and, on the Continent, an alcoholic tincture of the root is employed; but it has the inconvenience of being decomposed by water.

Contrajerva is a stimulant Diaphoretic of little power. Owing to its influence in retarding the progress of putrefaction in dead animal matter, it has been employed in low states if fever; but with little advantage. In combination with the carbonate of lime, it has been found useful in the dentition of weakly infants; where there is much acidity of the stomach, and the tone of the habit requires to be supported.

The remaining Diaphoretics of this description, which owe their efficacy to combined Volatile Oil, namely, Balm, Melissa *officinalis*, and Rosemary, Rosemarinus *officinalis*, are seldom employed, except as domestic medicines, and might be rejected from the list of Diaphoretics.

d. Camphor. *Camphora.* L. E. D. (p. 71.)—Experience has clearly ascertained that Camphor influences the cutaneous capillaries and produces a tendency to diaphoresis, without increasing the velocity of the pulse. It evidently acts on the cutaneous capillaries after absorption, as the insensible perspiration and the sweat smell of camphor. Camphor, however, except as a fumigation, is seldom employed alone as a Diaphoretic: in combination with antimonials and opium, it ensures the action of these substances on the skin. Its diaphoretic influence is undoubted; and, amongst the substances usually added to the warm-air bath, nothing proves more serviceable than Camphor.

* * *Inorganic Substances.*

f. salts.

1. Sesquicarbonate of Ammonia. *Ammoniæ Sesquicarbonas.* L. *Ammonia Carbonas.* E. D. (p. 189.)—This salt operates through the nervous system, and causes diaphoresis when aided by external warmth and plentiful tepid dilution. It is probable that, in producing this effect, the Ammonia acts solely on the nervous system—an opinion supported by the well-known fact, that the liniment of Ammonia, applied to the neck as a counter-irritant in inflammation of the tonsils, is invariably followed by copious perspiration, provided the patient be kept warm in bed. Carbonate of Ammonia is indicated as a Diaphoretic in the sinking stage of typhoid fevers, and other diseased conditions, in which, notwithstanding the presence of much debility, diaphoresis is still desired. In combination with guaiacum and opium, considerable advantage has been obtained from it in obstinate cases of chronic rheumatism: and, in such cases, its internal administration is aided by its external application in combination with camphor. To produce its diaphoretic

effects, the dose should not be less than *twelve*, nor more than *twenty* grains. In larger doses it causes vomiting. The best vehicle for administering it is the almond emulsion.

2. CITRATE OF AMMONIA. *Ammoniæ Citras.* This salt, which is generally prepared at the moment of its administration by saturating recent lemon-juice with carbonate of ammonia, possesses very moderate diaphoretic powers. It does not crystallize until its solution be evaporated, without heat, to the consistency of a thick syrup, when it shoots into long prisms. Its taste is cooling and moderately saline. It is very soluble in water; and is so easily decomposed, that the Ammonia is separated by the application of a moderate heat. According to the analysis of Vauquelin, it consists of citric acid 62 parts, + of ammonia 38, = 100 parts; or 1 eq. acid = 58·48, + 1 ammonia, = 17·15, making the equivalent 75·63. It may be prepared for medicinal purposes by adding fifteen grains of the carbonate of ammonia in solution to gr. x of citric acid. It possesses less diaphoretic power than the solution of acetate of ammonia; but it is not so nauseous, and consequently it is more generally used as a vehicle for other Diaphoretics—as, for instance, antimonials and opium; but, for this purpose, it is requisite to render the solution perfectly neutral.

3. CITRATE OF POTASSA, *Potassæ Citras*, is equally efficacious as a Diaphoretic, and more generally employed than the Citrate of Ammonia. It consists of citric acid 55, + potassa 45, = 100; or one equivalent of each of its components. It is also usually prepared at the moment of administering it; and, when given in a state of effervescence, is well adapted for allaying nausea. A scruple of the carbonate of potassa, dissolved in water, is added to half an ounce of lemon juice, diluted with f℥i of mint or any distilled water. Some practitioners still recommend the old method of taking the saline draught, namely, first swallowing the solution of the alkali, and immediately afterwards the lemon-juice, so as to extricate the whole of the carbonic acid in the stomach. This method has its advantages; the alkaline solution allays the irritability of the stomach, whilst the distension of the viscus by the carbonic acid, which is thus closely applied to its nerves, affords a certain degree of tone, without interfering with the diaphoretic operation of the neutral salt. The more common method, however, is to give it during the act of effervescence, by mixing the acid and the alkali before the mixture is swallowed.

4. SOLUTION OF ACETATE OF AMMONIA. *Ammoniæ Acetatis Liquor*. L. *Ammoniæ Acetatis Aqua*. E. D.—Acetate of Ammonia is seldom administered in the solid form. Its solution, which is the old Spiritus Mendereri, is very frequently employed. To prepare it, the acetic acid contained in distilled vinegar is saturated with carbonate of ammonia: the carbonic

acid flies off in the gaseous form, and the acetate, produced by the union of the acetic acid and the Ammonia, remains in solution. The variable strength of distilled vinegar renders this solution seldom of the same strength—a circumstance of little moment as far as regards its diaphoretic powers, but of some consequence in prescribing it in conjunction with many substances. The Edinburgh and Dublin Colleges order the vinegar of a density of 1005. A strictly neutral solution, which should be ascertained by means of litmus and turmeric paper, is requisite. When the alkali predominates, the solution of tartar-emetic, occasionally prescribed with it, is decomposed; when the vinegar is in excess, the usual dose of the antimonial excites vomiting. The excess of the carbonate of ammonia, also, renders this preparation injurious as a collyrium. As a Diaphoretic, or as a cooling lotion, or a collyrium, it is decomposed by many substances which might be inadvertently ordered in conjunction with it. Decomposition occurs with alum and lime water; but no precipitate is thrown down when the solution is strictly neutral: with bichloride of mercury a precipitate takes place; and when the alkali predominates, the acetate of lead, also, is thrown down; which, however, is owing to the carbonic acid of the excess of carbonate of ammonia forming an insoluble carbonate of lead. On this account, it is of great importance to have a perfectly neutral solution when it is administered, even in a diluted state, to wash down pills with the acetate of lead. The acetate of lead is not hurtful; but the carbonate is extremely deleterious, bringing on colica pictonum, and paralyzing the entire intestinal canal. The addition of magnesia to this solution extricates ammoniacal gas; which is owing to the magnesia forming a triple salt, an Acetate of Ammonia and magnesia, and consequently setting at liberty a portion of the Ammonia. It is also incompatible with the mineral acids, the alkalies and their carbonates: sulphate of iron strikes with it a reddish-brown hue; sulphate of zinc and magnesia, bichloride of mercury, and nitrate of silver, decompose it.

Were this salt easily procured in the solid form, the solution would always be of a uniform strength; but its volatility prevents its crystallization from being readily effected. It may, however, be procured by careful evaporation in vacuo, or by throwing streams of gaseous ammonia and of acetic acid into the same receiver, kept cool. If strong acetic acid be used for making the solution, and this be evaporated by a gentle heat, it crystallizes in needle-form crystals. By a slow sublimation, it is obtained in long, slender, flatted crystals, terminating in sharp points, of a pearl-white colour. This salt impresses the tongue with a sensation of coldness; and then of sweetness, mixed with a mawkish taste. It is very deliquescent. The constituents of neutral Acetate of Ammonia, as far as can be ascertained, are—Acetic Acid 75, + Ammonia 25, in 100 parts.

The ordinary Solution of Acetate of Ammonia is an excellent and efficient Diaphoretic, when aided by keeping the surface warm, and by tepid dilution: it lowers the pulse, and abates febrile heat; hence it is well adapted for cases of inflammatory fevers, and all diseases of excitement. When perfectly neutral, so that antimonials may be combined with it, without suffering decomposition, it is an admirable vehicle for administering antimonials and opium, greatly aiding the effect of both on the skin. The usual dose is from f℥iv to f℥xiii, which may be given in any bland fluid. It is easily retained on the stomach, and often allays the irritability of that organ.

g. WATER. *Aqua.*—This diaphoretic agent requires to be examined in two distinct states:

a. Cold Water.
b. Warm Water.

a. Cold Water implies that the temperature of the fluid does not exceed 65° Faht. Water, at this temperature, when taken into the stomach, during a febrile state of the habit with a dry skin, promotes the perspiratory function, and favours diaphoresis. The greater part of the matter of perspiration consists of water; and if the skin be kept warm, so as to check the action of the kidneys, the quantity of perspiration is generally in the ratio of the quantity of fluid taken into the stomach. But, besides this cause of the diaphoretic influence of water, it is also well known that the sudden impression of a draught of Cold Water upon the nerves of the stomach acts most forcibly in promoting diaphoresis. This effect of Cold Water is well known to men of intemperate habits, who, on retiring to bed in a state of intoxication, and awaking in the night, with a dry, feverish, parched tongue, a quick pulse, and a hot skin, find immediate relief by swallowing a large draught of Cold Water: the cutaneous capillaries consent with the stomach, and copious perspiration quickly ensues. By imitating this practice in fevers, a similar result is obtained: but much of the effect produced depends on the management of the patient during its administration. If the surface be kept warm, and the body be surrounded with non-conductors, a small quantity of water will produce the effect required.

b. Warm Water.—The production of a sudden reduction of heat, in delicate frames of body, even in fever, when the excitement is high, is hazardous; and, therefore, warm or tepid diluents are employed to effect the same result as cold water. In general, when tepid fluids are administered to excite sweating in continued fever, the quantity of water swallowed must be large; the surface ought to be kept warm, and small quantities of saline or aromatic matters combined with the tepid drink.

Besides being diaphoretic itself, water, both cold and hot, is

the general auxiliary of all other Diaphoretics; nor can their influence upon the skin be maintained for a sufficient length of time without its aid. When the fluid is intended rather to keep up perspiration than to induce it, the temperature of the water or the aqueous fluid should be at least 80°; when the object is to provoke sweating, the temperature should be about 100°, and the quantity considerable. The same rules, indeed, are necessary for regulating the administration of diluents, as for the external employment of water. When the temperature of the body is under 94° in disease, cold drink should not be administered: in fevers, therefore, when it is indicated, the temperature of the patient should be ascertained: he should remain in bed, in flannels, and the fluid be administered in small quantities, frequently repeated.

Upon the whole, the advantages of water as a sudorific, and for aiding in maintaining the sudorific effect of other Diaphoretics, is sufficiently obvious: the pure state of the fluid is the best for obtaining its diluent effects. Nature points out the indication for our guide, both as to its administration at first and the continuance of it, in the sensation of thirst which accompanies every state of febrile action in which diluents and Diaphoretics are required. Where this sensation is present, we cannot err in administering water; the temperature of the body and the state of the skin determining whether it should be cold or warm.

h. EMPYREUMATIC OIL.

The only oil of this kind which has been employed as a Diaphoretic is that of the liver of the cod fish.

COD-LIVER OIL. *Oleum Jecoris Aselli.*—This oil is procured from the whole of the genus *Gadus*, the Burbet and Ling, Lota *vulgaris*, and L. *mokoa*; and the Torck Brosmius *vulgaris*. It is chiefly prepared at Newfoundland from the livers of the cod caught on the great fishing bank. It has a deep golden-yellow, or a brownish colour, and a peculiar odour. In Germany, however, there are three varieties of Cod-liver oil; namely, *white*, *yellow*, and *red*: the principal components in all of them are *Iodide of Copper*, *Bromide of Potassium*, *Iodine*, and *Bromine**.

In doses of f℥ii, Cod-liver oil is said to exert a diaphoretic influence: but at the same time it causes so much nausea and such offensive eructations, that few persons can be induced to take it. It has been prescribed in chronic rheumatism: but in the only case in which I ever ordered it, the severe nausea and vomiting which supervened inclined me to believe that few stomachs are able to bear it with impunity. On this account the oil of the liver of the skate, Raia *clavata* and R. *Catis*, is proposed to be substituted for that of the Cod-liver. It contains more Iodide of Potassium than that of the cod. Cod-liver oil is chiefly

* Herberger, Pharm. Central Blat. für 1837.

indicated in the chronic form of rheumatism. The dose is f℥ss to f℥iss, twice or thrice a day. It may be administered in any aromatic water. Dr. Bardsley gave it in warm table beer*.

2. SIMPLE DIAPHORETIC SUBSTANCES WHICH ENTER THE CIRCULATION.

i. SULPHUR. L. E. D.—This simple substance is found abundantly in the vicinity of the craters of volcanoes, as, for instance, the *Solfatara*, a half-extinct crater, near Naples, where it is collected in considerable quantity. Much Sulphur is, also, procured in Sicily; and a moderate proportion from metallic ores. It forms a constituent of some animal and a few vegetable bodies. Before it can be medicinally used, it is purified by distillation from an iron still into a chamber, where it is deposited in the form of a powder of *flowers of Sulphur*. It is some time afterwards fused, and run into wooden moulds; and forms the *roll Sulphur* of commerce. Sulphur, after sublimation, according to the directions in the Pharmacopœias, contains a little acid, which is removed by washing, and the Sulphur is termed *Sulphur lotum*.

Sulphur is too well known to require description. When it is taken into the stomach, it passes into the circulation, and, augmenting the natural perspiration, is carried off through the cutaneous exhalants united with hydrogen—a fact demonstrated by silver, worn in the pockets of those taking it, becoming blackened in the same manner as if it had been exposed to a stream of sulphuretted hydrogen gas. As a Diaphoretic, Sulphur is prescribed in cases of chronic rheumatism, and some other skin diseases; and, in chronic catarrh, in combination with oil, under the form of *oleum sulphuretum:* which, however, is an acrid, nauseous preparation, and, consequently, is seldom administered. It is a simple solution of Sulphur in fixed oil; but, when heated, a decomposition of this oil takes place, and sulphuretted hydrogen gas is evolved. When properly prepared, it has a reddish-brown colour, a fœtid odour, an acrid taste, and a viscid consistence. The dose is from m. v to f℥ss, in any bland vehicle. The dose of Sulphur, to produce its diaphoretic effects, should not exceed half a drachm.

k. SULPHURET OF POTASSIUM. *Potassii Sulphuretum.* L. E. *Sulphuretum Potassæ.* D.—In combination with potassium, sulphur forms a solid and a fluid preparation, hepar sulphuris and hydrosulphuret of Potassa; both of which are diaphoretic. The solid Sulphuret, hepar sulphuris, when recently prepared, is a liver-coloured substance; but it soon becomes green by the action of the oxygen of the air. It is hard, brittle, and breaks with a vitreous fracture; its taste is bitter, acrid, and caustic; and it leaves a brown stain on the skin. In making this preparation, the carbonate of Potassa should be first exposed to a red

* Medical Reports.

heat in a crucible, before it is mixed with the sulphur. In melting the ingredients together, the Potassa, which is an oxide of potassium, is decomposed, the oxygen uniting with a portion of the sulphur, forms sulphuric acid, which combines with a part of the Potassa and produces a sulphate; whilst the remainder of the sulphur attaches itself to the uncombined potassium and forms a persulphuret; a portion of the Carbonate of Potassa remaining undecomposed. This preparation, therefore, is a compound of Persulphuret of Potassium and of Sulphate and Carbonate of Potassa. When dry, the solid Sulphuret has scarcely any odour; but, when moistened, it exhales the smell of sulphuretted hydrogen gas, owing to the decomposition of the water, and the union of its oxygen with one part of the sulphur and its hydrogen with another: the consequence of which is the formation of Sulphate of Potassa, and Hydroguretted Sulphuret of Potassa. That is to say, the sulphuric acid formed unites with a portion of the Potassa, and forms an additional quantity of Sulphate of Potassa, whilst the sulphuretted hydrogen combines with the Sulphuret of Potassium.

The liquid Sulphuret of Potassium is of a reddish-brown colour. When newly prepared, it has no odour; but, by keeping, it acquires a very fœtid smell; it feels soapy between the fingers, and stains the cuticle a greenish-black. The acids and the metallic salts decompose it. It ought to be preserved in well-stopped bottles, as it rapidly attracts oxygen from the atmosphere, and the greater part is converted into sulphate of potassa. Neither sulphuric, nitric, nor hydrochloric acid can be prescribed, even when largely diluted, with these preparations. If sulphuric acid be added, a precipitate of sulphur and sulphate of potassa takes place; when hydrochloric acid is added, the precipitate is sulphur in the state of a hydrate; whilst a Chloride of Potassium remains in solution, and hydro-sulphuric acid escapes in the form of gas.

Both these preparations have been employed as Diaphoretics in chronic asthma and chronic catarrh, and in several cutaneous affections; and, in combination with conium, in cancer, at least as palliatives*. In large doses, internally administered, they are virulent narcotico-acrid poisons, causing a burning pain and constriction of the gullet, pain of the stomach, vomiting and purging, which are followed by fainting, convulsions, and fatal collapse. Its dose, if internally administered, is m. x to fʒi.

l. MERCURIALS.

Mercurials, in whatever form, when introduced into the habit, are excreted by the skin, provided they do not pass off by

* The Dublin preparation is used as a lotion in dry furfuraceous affections. A lotion of it is prepared with fʒiii of the fluid Hydrosulphuret; fʒii of alcohol; ʒi of Soap, and f℥viii of Water.

the bowels; and this is particularly the case when the doses are small. This action of the salts of Mercury upon the capillary system has been long known; and, in having the cuticular discharge promoted by them, it is probable that the skin only shares as a secreting organ in the general influence which they exert on the glandular system. The mercury in these salts exhales from the skin, in a metallic or reduced state—at least, we draw this conclusion from observing their effect upon gold and silver worn in the pockets of those under a course of Mercury; but we cannot be certain whether this reduction takes place at the surface. All the preparations of Mercury, which exert a decided influence on the habit, are either oxides or chlorides, in which state they are taken into the circulation. How long they continue unaltered after being admitted into the blood, it is impossible to say; but the probability is, that some change takes place in the glandular system, upon which, undoubtedly, they exert their stimulant influence. In promoting the cuticular discharge, therefore, Mercury seems to operate as a general stimulant to the glandular system, in which, of course, the skin shares as a secreting organ: and, if we can draw a correct conclusion from the consequences, we are authorized to say that the mercurial oxides and chlorides employed, undergoing decomposition, give out oxygen or chlorine, whichever is their active principle. Be this as it may, the effect of mercurial preparations upon the cuticular discharge is demonstrated by daily experience; but, nevertheless, they are not administered as direct Diaphoretics, but merely as powerful auxiliaries in promoting the influence of other Diaphoretics. A query may be advanced, whether the action of Mercurials is confined to the capillary system? In reply, it must be admitted that Mercurials stimulate generally the vascular system; that the action of the heart and arteries is increased during a mercurial course, when the preparation is given in such a manner as to prevent it from operating as a purgative; but it is equally true that the peculiar effect of Mercury cannot be ascribed to its general stimulant influence; some specific action takes place upon the glandular and capillary systems, independent of the general increased force of the circulation; and it is to this that we are to ascribe its effects as a Diaphoretic.

Calomel, the *Chloride of Mercury* (p. 162), is the preparation usually selected for obtaining the action of Mercury on the skin. In prescribing it in combination with other Diaphoretics, it should be known that, if ammonia be ordered in combination with it, the Calomel is decomposed, the protoxotide or black oxide of Mercury is formed, and chloride of ammonia remains in the solution. The sulphuret and the hydro-sulphuret of potassa decompose Calomel, and convert it into the proto-sulphuret or black sulphuret. In both cases, the activity of the medicine is greatly

impaired by the change which takes place; and the dose of Calomel, which otherwise would be amply sufficient to produce its diaphoretic effect, becomes, by this decomposition, utterly inadequate for that purpose. Sulphuret of antimony also decomposes Calomel.

Calomel is scarcely ever exhibited alone, with the view of obtaining its diaphoretic influence. When combined with tartar emetic, James's powder, guaiacum, opium, or ipecacuanha, it imparts certainty to the sudorific powers of these substances. These combinations are given with advantage in all inflammatory affections, in cutaneous eruptions, and in chronic rheumatism. As a Diaphoretic, the dose of Calomel is one grain.

3. MECHANICAL DIAPHORETICS WHICH OPERATE WHEN APPLIED TO THE SURFACE.

Whether sweating or mere diaphoresis be produced, the cause of the perspiration, as far as the substances we have already examined are concerned, is the increased action of the whole vascular system; but as far as relates to the few remedial agents under this head, the increased excitement is wholly confined to the cutaneous vessels.

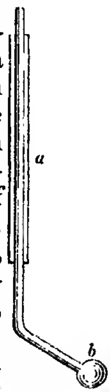
m. FRICTIONS.

These operate upon the cutaneous vessels directly, and may be considered equivalent to muscular exertion in producing sweating.

n. THE COLD AFFUSION.

When cold water is dashed upon the body, labouring under a state of febrile excitement, its effects are a diminution of the heat of the skin and the force and frequency of the pulse, diaphoresis, and sleep. These effects are not the result of the sedative influence of cold; for although this be great, and the abstraction of caloric is sufficient to reduce at once the temperature of the body from 106° to 94°, yet this alone would not produce that diaphoretic effect on which much of the advantage derived from the cold affusion depends; we must, therefore, look out for another cause, and we find it in the sudden and powerful shock which this mode of applying cold water gives to the whole system, and the salutary reaction which ensues. The use of the cold affusion as a Diaphoretic is indicated when the skin is hot and dry, the tongue parched, the face flushed, accompanied with headache and pulsating at the temples, restlessness, and watching. Perhaps it is less adapted to the fevers of our temperate climate than to those of tropical regions, when the general excitement is at its greatest

height. It is of much importance, however, to ascertain that no visceral inflammation exists, that the catamenia are not present, and that the patient is not in the latter months of pregnancy; as, in such conditions of the habit, dangerous effects might follow the employment of so powerful a shock. Even when no circumstance of the kind just mentioned contraindicate the use of the cold affusion, still the following precautions are necessary to be always kept in view.



1. The *temperature of the body* should be accurately ascertained by introducing the bulb, *b*, of a small curved thermometer, *a*, under the tongue, with the lips closed upon the instrument, or within the axilla. If the heat be under 96°, the cold affusion should not be applied; neither can it be used if perspiration be already present, even though the heat of the body at the moment be much greater than usual. Dr. Currie remarked that, under these circumstances, the application of cold water is accompanied by a diminution of temperature, and a deficiency of reaction, which are at least hazardous.

2. *When a sense of chilliness* is present, although the thermometer indicate a morbid degree of heat, the cold affusion is dangerous; suspending respiration, producing a feeble, frequent, and irregular pulse, and sudden collapse, which threatens, if it be not always followed by, extinction of life.

3. When fever is advanced, the temperature of the water should not be more than 15° or 20° below that of the body.

4. The patient, immediately after the use of the Cold Affusion, should be placed in bed, and some warm wine and water administered, to encourage the reaction, which is the object of the remedy.

Before applying the Cold Affusion, the hair of the patient should be removed; he should be stripped naked, and, being seated in a tub, four or five gallons of water, at 40° to 60°, should be thrown over him; and this should be repeated two or three times, or until a rigor comes on; after which he should be immediately removed to bed. The period of the evening exacerbation of fever, which in general occurs from six to nine o'clock, is perhaps the best time for using the affusion; but it may be advantageously employed at any time of the day, if the symptoms indicate the propriety of such a step. It is sometimes of advantage to add salt to the water; and Dr. Currie was of opinion, that by this addition the affusion is not only more grateful to the feelings of the patients, but it may be used for a length of time with much less hazard than when fresh water is employed.

The diaphoresis which follows should be maintained by free dilution with tepid fluids, as if it had been induced by any other of the means which have been described.

THERAPEUTICAL EMPLOYMENT OF DIAPHORETICS.

Direct Diaphoretics, in augmenting the action of the cutaneous capillaries, are well adapted for relieving internal congestions; diminishing febrile excitement, and, by the cooling influence of evaporation, reducing the morbid temperature of the body. They were very early employed in the cure of diseases: indeed, the common observations of men, in the most uninformed state of society, must have taught them that, when the body is labouring under febrile excitement, this immediately ceases if a sweat breaks out. It was natural, therefore, that means should have been sought for to promote this state, rather than to trust to it as a natural crisis: hence, in the treatment of diseases, sweating is a prevalent and proper remedy. On this account, however, the employment of Diaphoretics has been often abused—a charge not exclusively confined to the unprofessional.

The diseases in which Diaphoretics are decidedly indicated are *fevers;* but, as these vary in their characters, so also the mode of using Diaphoretics, in their treatment, must vary. In intermittent fevers, they have been administered in three ways—1, immediately before the cold stage, to prevent the accession of the paroxysm: 2, during the paroxysm, with the intention of bringing it to a speedy termination: and, 3, during the interval, to promote the natural perspiration, and to aid the return to health.

1. The cold stage is the first of the succession of symptoms which constitute the paroxysm of intermittents: it may be removed by exciting an opposite state; and accordingly we find that, when sweating can be induced about the commencement of this stage, the paroxysm is either lessened in violence, or it is shortened in duration, or altogether prevented. Now, how is sweating, in this case, to be effected?

Among rude nations, the simplest means for warming the body artificially are resorted to: the Negroes in Jamaica, for instance, Dr. John Hunter informs us, stretch themselves out in the sun; and, in this country I have seen the same means resorted to by the agricultural labourers in one of our ague counties; other equally rude tribes endeavour to diffuse the blood and throw it upon the surface by exercise, and therefore run vigorously as soon as they feel the least indication of the approach of the cold stage of the paroxysm. From the writings of Celsus we learn that the ancients employed the warm bath at the period of the anticipated accession. The bath was used half an hour before the rigour was expected; after which some sudorific medicine was administered, and, the patient being put into bed, the sweating, as soon as it occurred, was kept up by warm diluents. The influence of water, at the temperature just mentioned, is sufficient to excite the cutaneous capillaries, and to

cause sweating, provided the patient remain in the bath a sufficient length of time to produce also the secondary effects of the warm water, namely, its sedative influence in allaying irritation, relaxing spasm, and tranquillizing those desponding or hypochondriacal feelings that always, more or less, accompany the approach of the paroxysms in Ague; and which even the most courageous individuals are seldom able to withstand. This soothing influence of the warm bath seems almost essential to the production of its diaphoretic effects; the irritable and uneasy condition of the nervous system that accompanies the congestion, which constitutes the cold stage of Ague, by the accumulation of the circulating fluid upon the larger and internal vessels. It is not my province to enter into the question of the distinction between this state of sanguineous congestion and inflammation, although I have no hesitation in declaring my opinion that it is *not* inflammation: but it is sufficient for our purpose to know, that the first effect of the warm bath employed to prevent it, is one affecting the nervous system; that the tranquillity of the feelings thus produced, facilitates its excitant influence on the capillaries of the surface; and, as it were, solicits, rather than forces, that return of blood to the surface, which relieves the heart and the larger vessels, and enables them to aid the reaction which ultimately restores the balance of the circulation. In this view of the influence of the warm bath, as a means of exciting sweating, so as to set aside both the cold and the hot stage of the paroxysm in Ague; it is evident that, independent of its influence on the nervous system, it operates exactly in the same manner as all other diaphoretics, namely, as a temporary Excitant. It first stimulates the surface to increased action, and this is followed, after a time, by the opposite state, that of moderate collapse; and it is on this account that the warm bath is well calculated to produce the object held in view, when it is employed to check the fit of an Ague:—it stimulates the capillaries to that extent only which is required to favour diaphoresis.

In employing the warm bath in Intermittents, however, some cautions are necessary to be observed. Thus, in cases complicated with local inflammation, or determinations of blood to particular organs, bloodletting, either local or general, should *precede* its use; and the same precaution is requisite in persons of plethoric, or apoplectic, or hæmorrhagic tendencies: and in such cases, also, even after bloodletting, it is most advisable not to employ a bath of a higher temperature than 96°. Indeed, as it is the derivative and diaphoretic influence of the bath that is required, in Intermittents, the heat of the bath in no case should exceed 98°; but this temperature should be sustained as long as the patient remains in the bath. The period for remaining in the bath depends always on circumstances connected with each individual case. If the patient be in the vigour of life, and the

disease has not yet broken down his strength, he may remain until the velocity of a pulse, excited by the first impression of the warm water, is subdued, and a feeling of languor succeeds; but if the constitution be either naturally delicate, or has been weakened by the continuance of the disease, then the period should be limited to the first appearance of the excitement diminishing. As a means of causing diaphoresis, the warm bath can scarcely be regarded as proper in cases of much debility and relaxation of the system, even when the nature of the disease indicates its utility.

3. With respect to the employment of muscular exertion to promote diaphoresis, many instances might be adduced of the paroxysm of Ague having been prevented by running vigorously as soon as the first indication of the cold stage presented itself: and I have seen much advantage derived in acute rheumatism, when the patient had courage enough to undertake it in despite of the pain, which is always increased in the first effort.

4. The accession of the paroxysm of Ague used to be broken by Sydenham, by putting his patient to bed about four hours before its anticipated return, and, at the same time, exciting sweating by powerful *stimulating* sudorifics; and keeping up this state of the surface for several hours. But this practice, instead of shortening the paroxysm, often tended to lengthen and to render it more severe, by overstimulating the system: hence the consequence was, not unfrequently, the conversion of the *intermittent* into *continued* fever. The most usual method of checking the catenation of symptoms constituting the paroxysm of Ague, is the administration of an emetic at the period of its anticipated accession. A question here presents itself—Is the effect of the emetic to be attributed to the shock which it gives to the system; and is the equalization of the circulation the consequence of the reaction of this shock; or is it to be attributed to the diaphoresis which always, more or less, follows its action?

Now, in reply, if we must admit the beneficial influence of running, or violent muscular action, in producing a similar reaction, and restoration of the balance of the circulation, there is some reason for attributing the beneficial influence of Emetics, thus employed, to the shock and agitation which they give to the habit: but, at the same time, we must admit that the known sympathy between the stomach and the surface is such, that the nausea caused by the emetic on the stomach is usually followed by diaphoresis. Much caution is requisite in this mode of exciting diaphoresis, as any determination to the head may be followed by apoplexy, if the straining in the act of vomiting be considerable: and it is equally contraindicated when any tenderness exists at the epigastrium.

Opium is one of the most efficient diaphoretics, and one

which, after sufficient evacuations, may be most safely employed. When Opium is administered as a diaphoretic in Ague, it should be given in a full dose at the commencement of the paroxysm. A dose of m. 40 to m. 60, is the best adapted for this purpose. It rapidly subdues the headache which accompanies the hot stage; lessens the burning heat of the skin; and brings on a copious sweating, free from that burning sensation which always accompanies the sweating in the ordinary course of the hot stage, when no opiate has been administered. Opium is sometimes given, with advantage, in combination with calomel, in the intermissions. It maintains the cutaneous circulation, and does not interfere with, but rather promotes, the beneficial influence of Antiperiodics.

The paroxysm of Ague may be shortened and rendered milder by the administration, also, of Antimonials in combination with Opium; or of the Compound powder of Ipecacuanha. But although the diaphoresis thus excited, is, in a certain degree, due to the nauseating influence of the Antimonials and the Ipecacuanha, yet still more is due to the stimulant influence of the Opium on the capillaries: consequently, when symptoms of Synocha, or of inflammatory action be present, it ought not to be administered, even in conjunction with the nauseating diaphoretics. On the contrary, when the pulse is hard, quick, and full, and the breathing much embarrassed, the Antimonials and the Ipecacuanha should be combined with the Citrate or the Acetate of Ammonia, or the Citrate of Potassa in a state of solution: and the diaphoretic influence of these favoured by the previous use of the lancet, and by brisk purging.

By whatever means the sweating is induced in ague, it should be maintained by confinement to bed, and the free administration of tepid diluents, until the paroxysm has run its course. If the catenation of symptoms, however, do not yield to the administration of nauseating diaphoretics, and the hot stage come on, then cold water should be freely administered internally, and, also, applied externally, in the form of the cold affusion or of cold sponging, to shorten the cold stage, and to induce the critical diaphoresis.

5. Much difference of opinion has existed respecting the employment of diaphoretics in the intermissions in ague. There can be only one opinion respecting the impropriety of keeping up the action of sudorifics during the intermissions, as the great object at the time is to give tone, so as to enable the habit to bear up against the return of the next paroxysm; hence all Antiperiodics are more or less tonics; but, in this case, the intermissions are supposed to be perfect. When they are incomplete, bloodletting and purging, followed by calomel in combination with tartar emetic and opium, to excite diaphoresis, tend to render them more complete, and to prepare the way for the

more efficient influence of Antiperiodics. There can be no doubt that the efficiency of these is greatly aided by conjoining them with stimulating Diaphoretics. Thus the salts of Quina are more certain as Antiperiodics when they are given in combination with serpentaria, or some other stimulating sudorific, provided the temperament of the patient and the condition of his habit, at the time, do not contraindicate the employment of excitants. When the pulse is strong, full, and quick, or if anomalous pains, resembling those of rheumatism, attack various parts of the body, or any symptoms of local inflammation present themselves; then, however complete the Apyrexia may be, no stimulant Diaphoretic should be conjoined with the Antiperiodics. But, if the opposite condition of the habit, namely, languor and debility, be present, then the advantage of such combinations is undoubted. It is probable that the great advantage of the Arsenious Acid and the Arsenite of Potassa, as Antiperiodics, depends on their influence on the cutaneous capillaries, in combination with their tonic power.

Many circumstances, however, are to be taken into account, before combining sudorifics with antiperiodics, in the apyrexia of ague: namely, climate, season of the year, the age of the patient, and the nature of the prevailing epidemic. In India, we are informed that disulphate of quina and bark are the sovereign remedies in the jungle intermittents and remittents, during the *dry* season; but during the *rainy* season, these remedies are of no avail, and the successful treatment is that of diaphoresis, excited by calomel, antimonials, and opium.

As a general rule, we may consider the administration of stimulating diaphoretics better adapted, and more frequently indicated, for aiding the influence of antiperiodics, during the intermissions in ague, than the nauseating and the relaxing, which frequently tend to protract these fevers. Upon the ground that the heat and excitement in *continued fever* depends upon spasm of the extreme vessels, the doctrine of the beneficial influence of diaphoretics in that form of disease was founded. Sweating was regarded as the most important means of insuring a crisis; and this, altogether independent of the idea of peccant humour being expelled by that action of the skin. But, although it cannot be denied that a spontaneous diaphoresis often operates as a crisis in continued fever, yet it is equally certain that the same beneficial effect does not follow sweating caused by artificial means; and if it be attempted by stimulating diaphoretics, the febrile symptoms, instead of being allayed, are augmented.

A natural or spontaneous crisis in fever seldom occurs beyond the tenth or the twelfth day of the disease; and an artificial one, when it is attempted, rarely succeeds after the third or the fourth day: the sooner it is attempted, the greater is the probability of success.

Simple Diaphoretics.—In continued fever, diaphoresis, spontaneously excited, or artificially caused by mild means, is generally accompanied by an abatement of the symptoms: it is, therefore, important to administer that description of diaphoretic which will cause a gentle, yet generally diffused diaphoresis. For this purpose, several circumstances are requisite to be kept in view.

In the *first* place, the type of the fever must be carefully determined. In *synocha*, in which inflammatory symptoms always, more or less, prevail, the mildest diaphoretics should be selected: even when the fever is attended with great depression, the administration of stimulating diaphoretics requires considerable caution.

In the *second* place, the period of the fever must be kept in view. Every fever involves three distinct periods: namely—*a*, that of accession; *b*, that in which the fever is fully formed, or in its height; *c*, that in which it displays a tendency to terminate, whether in death or in recovery.

1. For the same reason that diaphoretics are indicated before the accession of the paroxysm of ague, they are beneficial in the commencement of continued fever; if they can arrest the first paroxysm, those which should follow may never appear; but they should be administered early, as the chance of cutting short a fever, by sweating, is diminished in the ratio of the time which the disease has continued. Even when the disease is completely formed, perspiration may prove beneficial, if it can be induced about the commencement of the exacerbation. But, if the diaphoretics do not quickly relieve the symptoms, and debility be expected, their use should be discontinued: and, in the last stage of fever, that being one of debility, sweating is always to be avoided.

2. The symptoms which indicate the use of diaphoretics, when the fever is fully formed, in continued fever, are high arterial action, a small concentrated pulse, heat, and dryness of the skin, restlessness, thirst, limpid urine without sediment; but a strong pulse, great determination to the head or the thorax, spontaneous sweating, especially if it is attended by a miliary eruption, contraindicate their employment. In every case in which sweating is likely to prove salutary, the perspiration flows readily and is diffused: on the contrary, when it flows with difficulty, is partial and inconsiderable, it is seldom beneficial; and, if the febrile symptoms increase, it is even dangerous.

The importance of cool air, and the internal and external use of cold and warm water in febrile affections, cannot be sufficiently urged. The cold affusion diminishes heat, lessens the frequency of the pulse, and is followed by diaphoresis and refreshing sleep. It is in the early stage of continued fever that this application of cold water is most beneficial: in the

advanced stage of the disease, or at any period, if there be much debility, the tepid affusion, or water of a temperature from 75° to 87°, is more advisable than the cold affusion. In many instances, either the cold or the tepid affusion is greatly objected to, not only by the patients, but by their friends; in which case, sponging or the simple washing the body with tepid water may be substituted. The same precautions, however, are requisite, whether the tepid affusion, or sponging, or washing be employed.

In looking into medical history, it is curious to observe how some of the early modes of practice, which were undeniably most efficacious, fell into disuse. Nothing demonstrates this more strikingly than the history of the *cold affusion.* Although the cold affusion was employed by the ancients, yet, it was neglected in modern practice, until the year 1786, when it was introduced to the notice of the profession, by the publication of its success in the treatment of fever by Dr. William Wright, of Jamaica. He first tried it in his own case, and, having benefited by it, he adopted it as a general line of practice in certain conditions of the skin in continued fever; and his statements of its beneficial influence has been amply confirmed by the experience of all those who have ventured to employ it. The method of ascertaining the temperature of the body, and the method of employing the cold affusion, have been already detailed. Its salutary influence depends on the reaction which it induces; it lowers the morbid heat of the surface, lessens the force and the frequency of the pulse, and induces copious perspiration and sleep. In fever, especially in some eruptive fevers, such, for example, as scarlatina, the sooner the cold affusion is resorted to, after the rigors of the first period of the attack are over, the better, provided the heat of the skin be considerably above that of the natural standard. The best time for using it is during the height of the exacerbation, or immediately after it has begun to decline; this commonly occurs late in the evening; but the affusion may be used at any time that the temperature of the body authorizes its employment. But, even in this state of the temperature of the surface, if the patients are suffering from a sensation of chilliness, it should not be employed; hence a practitioner, who is guided only by the thermometer, may fall into error.

With respect to the internal use of cold water, to excite diaphoresis in continued fevers, it is necessary to remember that it is only after the hot stage is completely formed, when the temperature of the body is above the natural standard, that cold fluids can be safely and advantageously administered. They operate in a manner similar to the cold affusion, but in a less degree, lowering the heat of the surface, lessening the frequency of the pulse, and disposing to diaphoresis and sleep. After the sweating has become general, the use of the cold fluids should be

left off, as they are useful only to *induce* and not to *maintain* Diaphoresis.

3. In the termination of continued fever, whether favourable or otherwise, diaphoresis is not indicated; and, indeed, when recovery is about to take place it would only tend to maintain the debility, which it is now the object of the treatment to obviate.

In the *Phlegmasiæ*, sudorifics are not generally indicated. They were formerly much employed in acute rheumatism; and as the spontaneous sweating in that disease always relieves the pain, their use seemed to be particularly pointed out. But acute rheumatism is now seldom treated with sudorifics; for, if they do not rapidly relieve the pains, the disease invariably increases in violence.

When *Gout* was considered to depend upon the presence of some morbific matter, which required to be expelled, the skin was supposed to be the natural emunctory, and diaphoretics were freely employed. More correct views of this painful affection have set aside this opinion; but, still, after purging and the use of sedatives, diaphoretics are employed as auxiliaries. The best mode of keeping the skin active in gout is warm bathing and frictions. It is indeed justly remarked that a freely perspiring skin is most powerful in obviating plethora, both *nutritive* and *excrementitious;* hence its utility in gout.

There can be only one opinion respecting the propriety of employing sudorifics in *Dysentery.* Ipecacuanha, in combination with Opium, is here our best hold. This combination may be given in large doses, in conjunction with extract of Gentian, which prevents the ipecacuanha from exciting vomiting. It allays irritation and tenesmus, and aids the favourable termination of the disease more decidedly than when nausea is induced. The general covering of the body should be light, but of a non-conducting nature.

Among the ancients, sweating was a common mode of treating *Dropsy;* and it has occasionally been used by the moderns, when the skin is harsh and dry; but sweating is not applicable to all dropsies. After sweating, the excretion of urine is sometimes augmented, and the accumulation of the dropsical fluid is so much diminished that a bandage is sometimes required: but, as it is probable that these effects depend on the reduction of the inflammatory diathesis, that is more quickly and effectually produced by the use of the lancet than by diaphoretics. There is no doubt, however, that sudorifics are useful auxiliaries in the treatment of dropsy; but they are less useful than cathartics.

In *cutaneous diseases,* antimonial diaphoretics have been found beneficial. All the preparations of mercury which prove useful in these troublesome affections, owe much of their efficacy to their action on the cutaneous capillaries. Many of the vegetable remedies, also, which have proved salutary in skin diseases, belong to this tribe of medicines: and we may ascribe the benefit

derived from the employment of the warm bath to its diaphoretic influence.

Many of the remedies used in the secondary form of *Syphilis* are sudorifics: namely, *Guaiacum, Sarsaparilla, Mercury, Antimonials, Iodides.* How far their beneficial effects are to be ascribed to their sudorific powers, I will not venture to decide. In warmer climates, where there is a constant determination to the skin, vegetable diaphoretics have succeeded in relieving and curing Syphilis more frequently than in temperate and cold countries. When Guaiacum was introduced as a remedy in syphilis, much of the benefit which in many instances resulted from its employment was ascribed to its being used in the West Indies; and patients were sent there to be cured by it, on whom it displayed no influence when it was employed in Europe. It would, however, be ascribing too much to diaphoresis to suppose that it expelled the syphilitic virus by the surface, an opinion which was at one time prevalent. In warm climates, the facility of curing this disease was certainly greater than in cold climates; but, as far as respects the natives, something is due to their simple habits and mild diet, as well as to the indolence and rest which are more essential in warm climates.

Upon the whole, the importance of Diaphoretics in the treatment of febrile affections is undoubted; but they have been too indiscriminately employed and too exclusively relied upon. As pathology advances, their employment is likely to be much circumscribed; and, consequently, when they are really indicated, the anticipations of advantage from them are more likely to be realized.

SECTION XIX.

EPISPASTICS.—MEDICAMENTA EPISPASTICA.

Epispastics, in the ancient acceptation of the term, meant substances that inflame the skin; but the term includes also those which cause *vesication* and *erosion.* The ancients arranged Epispastics according to their effects: the gentlest they named *phænigmoi;* the next, *sinapismi;* the third, *vesicatorii;* and the fourth, or most powerful, *caustici.* This division is judicious; but the latter term, caustici, is too general a phrase, comprehending not only caustics that destroy the vitality of the part, by the excess of their stimulant power, such as the actual cautery, but those, also, that operate by their chemical properties, which belong to *Escharotics.* I have, therefore, arranged Epispastics under the following divisions:—1, *Rubefacients;* 2, *Vesicants;* 3, *Erodents.*

1. Rubefacients, *Rubefacientia*, are substances that redden the skin, by exciting moderate inflammation of the capillaries; and cause a certain degree of pain, by stimulating the extreme nerves of sensation. This may be effected by *mechanical* or by *vital* means.

The operation of a *moderate Rubefacient* is purely local; it augments the action of the cutaneous capillaries, and operates as a counterirritant; but that of a *powerful Rubefacient* is general, the excitement which it causes extending over the whole habit. Thus, if a liniment, composed of two parts of fixed oil and one part of ammonia, be rubbed on the neck, in inflammation of the tonsils, the inflamed organs are relieved by the inflammation set up on the surface acting as a counterirritant; but if these proportions be reversed, diaphoresis is also induced, and the febrile symptoms are mitigated in violence. But it is necessary to remark, that when Rubefacients are applied to relieve local pains, or inflammation not accompanied by general fever, they seldom operate in this secondary manner. Their general effect, therefore, may depend on a change of morbid action begun in a part and extended by nervous sympathy to the whole of the system; it must, consequently, be regarded as accidental. In this case, the local action more than counterbalances the general excitement, and produces what is termed a derivation of action. Another effect of Rubefacients is to be referred to the pain which they induce diverting the attention of the patient from the seat of the morbid action. In treating of the influence of mind in modifying the operation of medicines, I pointed out the difficulty of curing some painful diseases as long as the attention is powerfully directed to the seat of the disease: Rubefacients operate by withdrawing the attention, and thereby enabling the natural efforts of the system to repair any irregular action in the affected part. If their influence can be maintained for a sufficient length of time, the diseased action which it had arrested will not return; hence, in many instances, the proper employment of this variety of Epispastics is productive of much benefit in internal inflammations, in scrofulous affections of the joints, and in strumous swellings. It has been contended that Rubefacients owe much of their benefit to the friction employed; but in many cases no friction is employed. Strong friction, however, may be employed to produce a rubefacient effect.

2. Vesicants.—Most of the substances operating as rubefacients, when augmented in strength, cause an effusion of serum between the cutis vera and the cuticle, and thus become Vesicants. The primary action of a Vesicant, therefore, is that of a rubefacient, extended beyond a certain limit: the heat, redness, swelling, and pain, are greater; and affusion is the result of this increased action. The skin being an exhalant organ, a large quantity of fluid is thrown off by it, in the usual exercise

of its healthy function; and this exhalation is increased when the extreme vessels are excited, as long as the cuticle is sufficient to transmit the perspired fluid within a certain limit; and it is only when the inflammatory action is augmented that the cuticle loses its exhalant functions, and vesication occurs. Perhaps something is also due to the effect of the hasty secretion of the serum, which contains a larger quantity of coagulable matter than in its usual state: now we know that the cuticle is calculated to transude only a thin fluid; it is, therefore, incapable of allowing this denser fluid to pass through it; and it is, consequently, forcibly raised from the true skin. The serum of blisters has been chemically examined by M. Magueron, in the Hôtel des Invalides: he found that it contains a much larger proportion of albumen than exists in the ordinary cuticular exhalation. In one hundred parts of the fluid of a blister, he obtained eighteen parts of *albumen*, two of *chloride of sodium*, one of *carbonate of soda*, one of *phosphate of lime*, and seventy-eight of *water*. He ascertained that the nature of this fluid is the same, whether the blister be caused by Vesicants, properly so called, or by Sinapisms, or by hot water, or by the stings of insects.

The benefit arising from the blisters was formerly ascribed to the discharge which they produce; but it was first observed by Stoll that this is too small to be productive of much benefit; hence he remarks, "non suppuratio sed stimulus prodest;" and it is on this account that the repetition of blisters in inflammation of mucous membranes is more useful than a continued discharge from one. It is true that the effusion of serum internally is checked by blisters; and it has been affirmed that they effect this by "extracting serum from the mass of blood in the adjoining vessels*:" but, if the counterirritant effect lessen the determination of blood to the internal organ, the effusion of serum will be necessarily lessened, independent of any diminution of this component of the blood which a blister can effect. If the degree of morbid action be lessened, the consequences of high action will not follow. The benefit which they produce is truly to be attributed to their local stimulant action, as counter-irritants, and the sympathy which exists between the skin and the mucous and serous membranes. This was known to the ancients. Hippocrates, who invented blisters, applied them in the hope of transferring diseased action from the interior to the surface, or, as it has been termed, on the doctrine of revulsion.

The stimulant influence of blisters is sometimes useful in rousing the general powers of the system in low fevers, and in subduing states of inordinate action of the moving fibres. They

* Cyclopædia of Practical Medicine; art. Counterirritation.

have even been found to influence the mental energies; and have been applied by men engaged in public business when great displays were required*; but, although their first effect on the mental faculties be excitant, yet their secondary is depressing; and, on this account, the action of a blister is followed by a disposition to sleep. The general stimulant influence of blisters points out the necessity of caution in their application, until excitement be reduced by bleeding, purging, and other depleting measures, in inflammatory diseases. It has been asserted that they ought not to be applied over parts covered with an erysipelatous eruption; but this precaution is unnecessary: on the contrary, the new action induced by a blister is often productive of the most permanent sanative results. They are, however, contraindicated in several conditions of the habit: for example, when the excitement which they induce is likely to be followed by collapse. It is on this account that children do not bear blistering with impunity, and sometimes suffer from phagedenic ulceration after the application of a blister. I have seen even gangrene and death follow the application of a blister on an infant. This effect of blisters on children, however, may be prevented by never allowing the blistering agent to remain longer applied than is absolutely requisite for exciting the degree of inflammation sufficient to raise the cuticle; thus, if the plaster of cantharides be used, it should be removed in four or six hours at the utmost. When a disposition to phagedena or gangrene displays itself, the local application of the chlorides and poultices, with the administration of tonics internally, should be immediately resorted to. Blisters, as I have already stated, are frequently employed to rouse the powers of the habit in the low stages of fever, particularly in typhus; but, when the powers of the system are much reduced, they should not be applied to the feet and ankles; for they either fail to rise, owing to the very diminished excitability of the part, or, if they act, the blistered surface is apt to run into gangrene. Vesicants are, in fact, to be regarded as counterirritants rapidly exerting their influence; and, as we shall afterwards find, they are, in this point of view, remedies of considerable importance.

3. Erodents do not produce their effects in the same manner as *rubefacients* and *vesicants*. The inflammation caused by the two latter is erythematic; that excited by Erodents is phlegmonous. Erodents also differ from Cauterants: the former cause inflammation which terminates in pustules, that run their course and suppurate freely: the latter produce deep-seated ulceration and destruction of the part to which they are applied. The advantage of Erodents over rubefacients and

* This was the custom of the celebrated Dunning, the barrister; and my friend, the late Sir James Mackintosh, informed me that he had once tried the influence of a blister when he had to make a display in the House of Commons, and was satisfied with its effects.

vesicants is the permanence of their effects; although some part of the benefit is due to the discharge and the derivation of a large supply of the circulating fluid to the part. Much, however, depends on the nature of the substance employed, and the manner in which it is applied. It should be always remembered that, after Erodents have been in continued action for some months, they cannot at once be discontinued without risk. Thus, apoplexy has occurred almost immediately after drying up an issue, in the same manner, and on the same principle, as when a sore leg or an ulcer has been suddenly healed. At the same time, the action of an erodent continued after the intended effect is obtained, may set up a new and morbid action, which, from being local, will gradually extend to the whole system.

The difference between the discharge from the operation of a *Vesicant* and an *Erodent* depends upon the action of the former being confined to the capillaries or exhalant vessels; whilst that of the latter is extended to deeper-seated and more important arterial branches.

In whichever manner Epispastics operate, they exert an immediate influence on the skin; a secondary influence on distant organs. Nature confirms the truth of this remark, by displaying the powerful effect of cutaneous eruptions on functional diseases of the internal organs: even in exanthematous fevers, the febrile action generally subsides as soon as the eruption appears; nor is the occasional opposite effect any argument against the general result.

TABLE OF EPISPASTICS.

A. SUBSTANCES WHICH, IN CERTAIN QUANTITY, OR DILUTED, OPERATE AS RUBEFACIENTS.

* *Organic Products.*

a.—Acrid Oil, contained in

Bulbs—Allium *Sativum*.	6.	1.	Liliaceæ.
Fruit—Capsicum *annuum*.	5.	1.	Solanaceæ.
Seeds—Sinapis *nigra*.	15.	2.	Cruciferæ.

b.—Volatile Oils.

Oil of Turpentine.

Oil of Cajeput.

* * *Inorganic Substances.*

c.—Ammonia, } modified by combination.
d.—Acids, }

e.—Hot Water, between 120° and 150°.

B. SUBSTANCES WHICH OPERATE AS VESICANTS.

* *Organic Products.*

Animal.

a.—CANTHARIDIN, contained in

Cantharis *vesicatoria.*	4.	5.	Coleoptera.
——— *vittata.*			———
* Mylabris *variabilis.*			———
* ——— *Füsselini.*			———
* ——— *Chicorii.*			———
* Meloe *majalis.*			———
* ——— *trianthemum.*			———

Vegetable.

b.—ACRID PRINCIPLE, contained in

Roots—Ranunculus *acris.*	13.	7.	Ranunculaceæ.
——— *flammula.*	—	–	———
* ——— *sceleratus.*	—	–	———

* * *Inorganic Substances.*

c.—AMMONIA.
d.—NITRATE OF SILVER.
e.—STEAM.
f.—HEATED METAL.

C. ERODENTS.

* *Organic Products.*

a.—ACRID OIL, contained in

Bulbs—Lilium *album.*	6.	1.	Liliaceæ.
Barks—Daphne *Mezereum.*	8.	1.	Thymalaceæ.
* ——— *Gnidium.*			———
Croton Oil.			

b.—OLEO-RESINS.
Burgundy Pitch,
Galbanum,
Ammoniacum.
c.—CREASOTE.

* * *Inorganic Substances.*

d.—ACIDS.
e.—TARTRATE OF ANTIMONY AND POTASSA.

* * * *Mechanical Erodents.*

f.—ISSUES.
g.—SETONS.

* * * * *Cauterant Erodents.*

h.—Moxas.
i.—White hot Iron.

A. ORGANIC SUBSTANCES WHICH OPERATE AS RUBEFACIENTS WHEN APPLIED TO THE SKIN.

a. Acrid Oil is seldom employed in its separate state; but, in its natural combinations with other vegetable constituents, it forms the active principle of several rubefacients.

1. Garlic. *Allium.* L. E. D.—The plant Allium *sativum*, of which this is the bulb, is a native of Sicily, Spain, and Egypt, belonging to the natural order Liliaceæ. It is cultivated in every part of Europe*. The bulbs are small, numerous, and congregated in a common membrane, which surmounts the proper roots. The separate bulbs are named *cloves.* They have a strong, disagreeable, penetrating fœtid, odour, and an acrid, sweetish taste. According to the analysis of Bouillon Legrange, they contain *sugar, gum, albumen, extractive*, a *heavy, yellow, fœtid, acrid, volatile oil*, which is their active principle, and contains a small proportion of sulphur.

Garlic is a stimulant, whether applied topically, or internally administered. When applied to the skin in its recent state beat into a pulp or the juice expressed, it causes pain, redness, and, if continued longer on the part, vesication. A liniment, composed of two cloves of Garlic beaten into a pulp with f℥ii of Olive oil, has been found useful in sciatica and other deep-seated local pains.

Capsicum. *Capsicum.* L. E *Capsicum annuum.* D.—The Capsicum *annuum* is a native of most tropical climates, belonging to the natural order Solanaceæ. There are many species of Capsicum, but the C. *annuum* is the only officinal species (p. 81). It is a powerful topical and general excitant, and is successfully counterirritant when employed as a rubefacient. The powder has been sprinkled in the socks of those who have cold feet. The Tincture is an excellent addition to other stimulant liniments, employed as rubefacients.

Tincture of Capsicum. *Tinctura Capsici.* L. E. D.—Take of Capsicum ʒx, Proof Spirit Oii; digest for fourteen days, press the residue, and strain. The Edinburgh College orders it to be also prepared by percolation.

* Woodville's Med. Bot. third edition, page 749, pl. 256. London Dispensatory, art. Allium. Richard, Hist. Nat. Med. tome i, page 382 Hayne, vi, 6. Lindley, 593.

MUSTARD. *Sinapis.* L. *Sinapi.* E. *Semina Sinapis.* D.—The chemical nature of the flour of Mustard, formed from the marc after the fixed oil has been expressed from the seeds, has been already noticed (p. 89). It excites little topical irritation when rubbed upon the skin in a dry state; but, when made into a paste with water, it excites the cutaneous capillaries and nerves, causing both redness and intense pain, and, if the application be continued, ulceration and even sloughing. This depends on the volatile oil, developed by the water, which, in its separate state, is a powerful rubefacient and vesicatory; and although alcohol injures the powers of flour of Mustard, yet, a liniment, formed with *one part* of the oil and *twenty parts* of proof spirit, is an adequate substitute for a sinapism. The usual addition of vinegar to the mustard cataplasms rather lessens than augments its excitant powers. Recently ground flour of Mustard is more active than that which has been long kept.

When sinapisms are applied to the skin, their first effect is heat on the part, which increases to burning of almost intolerable intensity, so that a patient cannot long support it: whilst a sensation of general fulness, with throbbing of the temples, follow. The rubefacient effect is not equal to the intensity of the pain; and it seldom takes place until after the sinapism is removed, and the skin long remains of a deep crimson or purple hue. The feelings of the patient is the best regulator of the length of the application: if the plaster be too long left on the place, vesication and even gangrene have been known to ensue: hence, in cases where the sensibility of the patient is low, sinapisms should not be allowed to remain on longer than half an hour. They are valuable remedies when it is important to raise a quick and an efficient counterirritant effect. As no absorption takes place, they are less objectionable, in cases of general inflammation, than garlic. They are indicated in all cases of local determinations; to allay deep-rooted pains or inflammation; or for arousing from stupor in low conditions of the vital functions, such as occur in typhus fever.

In the following directions for making the Mustard Cataplasm, both the Linseed meal and the Vinegar are improper additions to the flour of Mustard. A thin paste, made with the flour and tepid water, is adequate for every purpose in cases where a sinapism is indicated.

MUSTARD CATAPLASM. *Cataplasma Sinapis.* L. D.—Take of flour of Mustard, and Linseed meal, of each *half a pound;* warm Vinegar, a sufficiency, make them into Cataplasm (which may be strengthened with ℥ii of horse-radish, D.). The horse-radish is not requisite, when the simple Mustard paste is employed.

b. VOLATILE OILS are local excitants, and may be employed as rubefacients; but two only are specially used as such.

1. Oil of Turpentine. *Terebinthinæ Oleum.* L. E. D.—This oil may be employed either in its separate state, or in combination in what is termed Burgundy pitch. This is distilled from every variety of Turpentine, most generally in water, and is purified by a second distillation with caustic Potassa. The pure or rectified oil is thin, transparent, colourless, and of a density from 866 to 880: it has a peculiar, penetrating odour, modified by the nature of the Turpentine from which it is obtained: the taste is acrid, bitter, and somewhat aromatic, but nevertheless nauseous*. Oil of Turpentine boils at 312°, and at a high temperature burns with a red, dense flame, and exhales much smoke. It is sparingly soluble in water, more soluble in alcohol, and completely soluble in ether. It inflames in chlorine gas; Iodine dropped into it causes an explosion, and is partly dissolved in it: and when hydrochloric acid gas is passed through it, a granular compound is formed, which has been termed *Artificial Camphor*. It is a solvent of resins, fixed oils, fats, caoutchouc, and several of the alkaloids.

Pure Oil of Turpentine is a compound of 88·24 per cent. of Carbon, + 11·76 of Hydrogen, = 100·00, or $C.^{10}$ $H.^{8}$ equiv. = 69·20. When exposed to the air, it attracts and thickens like a varnish. Oil of Turpentine is a topical irritant, acting rapidly, and causing not only redness of the skin and an intense pricking pain, but occasionally a papular eruption and minute vesications. It is, therefore, a valuable counter-irritant rubefacient in peritoneal and other internal inflammations†; and for quickening action in indolent tumors. The following officinal liniment is the common form of applying Oil of Turpentine topically; but I have found it more useful, in peritoneal inflammation, when simply combined with an equal quantity of Tincture of Opium.

Liniment of Turpentine. *Linimentum Terebinthinæ.* L. E. D. —The London College orders ℥ii of soft Soap, ℥i of Camphor, and f℥xvi of Oil of Turpentine to be mixed together by shaking. The Edinburgh College directs f℥v of Oil of Turpentine and ℥ss of Camphor to be gradually mixed with ℥iv of melted resinous ointment, till a uniform liniment is formed. The Dublin College orders lb. ss of Oil of Turpentine to be mixed with lb. i of Resin Ointment melted to form a liniment.

2. Cajeput Oil. *Cajeputi Oleum.* L. E. D. (p. 89.)—This oil, diluted with an equal quantity of olive oil, is a useful Rubefacient in gout and rheumatism, and aids also in restoring vigour to joints weakened by sprains. It possesses, however, no particular advantages over any other volatile oil.

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* Dumas.

† The liniment of a late celebrated Empiric, St. John Long, consisted of oil of turpentine and acetic acid, suspended by yolk of egg.—Lancet, 1837.

** *Inorganic Substances.*

c. Ammonia. L. E. D.—For rubefacient purposes, pure Ammonia may be extricated, at the time of its action, from the decomposition of hydrochlorate of Ammonia by the mineral alkali contained in soap. A plaster is made by combining ℥i of soap with ʒii of common litharge plaster; and, when spread upon leather and nearly cold, sprinkling on it ʒi of hydrochlorate of Ammonia in fine powder. From this plaster nearly a scruple of Ammonia, in a pure state, is slowly evolved, and exerts its action on the skin at the moment of its extrication. Too much of the hydrochlorate should not be used, as the first action is less than that which follows, owing to the inflammation induced. If it be requisite to maintain the rubefacient effect, the plaster must be renewed as soon as the decomposition of the hydrochlorate is completed; but the quantity of the salt must be successively less in each plaster after the first. Where the quick influence of a rubefacient is required, as in attacks of violent spasm in the viscera of the thorax or the abdomen, or gout in the stomach, and similar affections, this is a very useful form of rubefacient.

Liniment of Ammonia. *Linimentum Ammoniæ.* L. E. D. —Take f℥i of solution of Ammonia, and f℥ii of Olive Oil; shake them together until they are mixed. This solution of Ammonia, softened by being formed into a kind of soap with bland oil, is a useful and very frequently employed rubefacient. It is one of those superficial excitants which extends its action to the general system, causing diaphoresis; a quality of great importance in many local inflammations, when the strength will not admit of the employment of the lancet or much depletion. The proportions of the Ammonia and the oil may be equal for some habits of little susceptibility.

d. Acids. *Sulphuric Acid,* combined with ten times its weight of lard, forms a liniment which produces a rubefacient effect. The *strong Acetic Acid,* when diluted with an equal weight of water, reddens the skin, and may be employed as a rubefacient. But neither of these acids is much used for rubefacient purposes.

e. Hot Water.—Moderate degrees of heat—namely, between 120° and 150°, in combination with water—act as rubefacients on the skin. Poultices and fomentations, therefore, are often successful in removing, by counterirritation, slight internal inflammations; and a rubefacient property added to the pediluvium, by augmenting its temperature as much as the patient can bear, aids greatly its derivative influence. Fomentations, also, when used very hot, relieve spasmodic affections: and this can be referred only to their rubefacient influence.

B. SUBSTANCES WHICH OPERATE AS VESICANTS, AND WHICH, PROPERLY DILUTED, MAY BE EMPLOYED AS RUBEFACIENTS.

* *Organic Products.*

Animal.

a. CANTHARIDIN.—This substance is the active principle of the Spanish fly, or blister beetle, Cantharis *vesicatoria;* of the Potato fly, Cantharis *vittata*, employed as a vesicant in America; the Meloe *niger*, the Mylabris *variabilis*, and several other Coleoptera. The Mylabris is a Coleopterous insect, introduced from China, as a vesicating agent, which seems to possess in an eminent degree all the properties of the blister beetle. The Meloe *niger*, although it has the advantage of not causing strangury, yet has not been employed as a vesicatory in this country: it has not been determined whether its active principle is Cantharidin.

The Emplastrum Cantharidis of the Pharmacopœias, the substance commonly applied for producing a blister in this country, has some disadvantages attending its employment. It consists of one part of finely powdered Cantharides, blended with one or two parts of wax plaster. In the first place, the formation of the plaster by heat injures the activity of the Cantharides; in the second place, there is great waste, as only those particles of the powdered insect which are upon the surface are of use. It would, therefore, be much better were some kind of semi-adhesive paste contrived for forming the basis of the plaster, upon which the powdered Cantharides could be sprinkled before applying the plaster to the skin. Were Cantharidin easily prepared, the most certain blister would be a solution of that substance in oil; but the tediousness of the process, and the smallness of the product, render it impossible to employ it for ordinary purposes. The plaster of Cantharides causes, first, a sensation of heat and pricking in the part, attended with some general excitement and increased quickness of the pulse: if it remain on a sufficient space of time—namely, from six to ten hours—the cuticle is raised, and betwixt it and the true skin a yellowish serum is deposited. Sometimes fresh blisters continue to rise round the first blister after the plaster has been removed. Both the degree of excitement and the character of the effused serum, and its quantity, are greatly modified by circumstances connected with the general habits of individuals, and the disease for which the blister is applied. In many persons, the acrid principle of the insect is carried into the circulation and produces strangury; especially when the blister is applied to the scalp. In this case the hair should be removed some hours before applying the blister, if the necessity of the case admit of delay. The usual time for permitting a blistering plaster to remain applied is ten or twelve

hours, when it is usual to puncture the blister, and, after discharging the fluid, again to apply the plaster. This practice is to be reprobated, inasmuch as it does not answer any beneficial purpose, and it favours the absorption of the Cantharidin and the consequent production of strangury. As soon as a blister has risen, the plaster ought to be removed, and the fluid discharged. In children, in particular, this rule should always be attended to; as, owing to great irritability of skin, they are not only more easily blistered than adults, but, when the blistering plaster is permitted to remain too long applied, spreading, irritable, sometimes gangrenous, ulcers are apt to supervene. When this happens, the strength of the patient must be sustained by bark, or other tonics, the irritability of the part soothed by poultices made with a strong decoction of poppies, and every method which can change the irritable state of the habit into one of tone must be adopted.

Blisters, by whatever means raised, should be applied as near as possible to the affected part. They should also be as large as the nature of the part will permit; large blisters causing no more pain than small. In every instance, the blistering plaster should be kept in close contact with the skin by a few strips of adhesive plaster or a bandage; nevertheless, the pressure ought not to be so great as to restrain the inflammation of the capillaries and prevent vesication. Strangury is best obviated by interposing something between the blistering plaster and the skin. Gauze, or muslin, or thin paper moistened with oil, pressed down upon the blistering plaster, answers the purpose effectually, does not prevent vesication, and enables the plaster to be removed in a more cleanly manner. When the tendency to strangury is great, the blistering plaster ought not to remain on longer than is necessary to effect vesication, which takes place generally at the distance of eight hours, even when the blister plaster has been removed two hours before that time, and no vesication be then present. When strangury occurs, it is allayed by diluting freely, and introducing a pill containing a few grains of opium within the rectum, or throwing into the gut a pint of warm water containing from thirty to fifty minims of the tincture of opium.

Dr. Fohr, of Gundelfingen, recommends the following as a certain and rapid agent for producing vesication. Take bruised Cantharides, concentrated acetic acid, and alcohol, equal parts. Digest for several days and strain. This tincture blisters instantly when applied on linen, or rubbed on the skin*. It may be asked, will it not blister independent of the Cantharides?

Plaster of Cantharidis. *Emplastrum Cantharidis.* L. E. D. —The London College orders lb. i of cantharides to be mixed

* Pommer's Zeitchrift.

with lb. iss of wax plaster, melted. The Edinburgh and Dublin formula is as follows: take of cantharidis, in very fine powder, ℥ii (ʒxii, D.); wax, ℥ii (℥xii, D.); resin, ℥ii (ʒiv, D.); suet, ℥ii (℥vi, and lard ℥vi, D.). Melt the fats together, remove the mixture from the heat, and sprinkle in the cantharidis, stirring briskly as the mixture concretes.

This is usually spread upon leather or adhesive plaster, to form a blistering plaster; which may be removed as soon as it begins to rise. In this plaster, as the surface only vesicates, there is a great waste of Cantharides.

COMPOUND CANTHARIDIS PLASTER. *Emplastrum Cantharidis compositum.* E.—Take ℥ivss of Venice turpentine; ℥iii each of Burgundy pitch and of Cantharidis; ʒi of wax; ʒss of verdigris; ʒii each of white mustard seed and black pepper. Melt the wax and Burgundy pitch, then add the turpentine, and, while the mixture is hot, sprinkle into it the remaining articles, previously reduced to fine powder, and mix together; stir the whole briskly, as the mixture concretes in cooling.

This plaster possesses no advantages over the former, although it ought to be superior, as it causes more pain. The best blistering plaster is made with an etherial tincture of impure cantharidin, spread upon waxed linen.

VINEGAR OF CANTHARIDIS. *Acetum Cantharidis.* L. E.—The London College orders ℥ii of powdered cantharidis to be macerated for eight days in Oi of acetic acid (density 1048), then expressed and strained. The Edinburgh directs ℥iii of powdered cantharidis, f℥v of acetic acid, f℥xv of pyroligneous acid (density 1034), and ℥ss of euphorbium, in coarse powder, to be macerated together for seven days, strained, strongly expressed, and the liquor filtered.

The Cantharidis is of little value in these preparations; for, unless the acids be strong, no vesication takes place; and if they are strong, they vesicate independent of the cantharidis. They may be applied with a piece of bibulous paper, and a poultice placed over the part as soon as the inflammation commences.

A blister is also raised in a few minutes by an ointment composed of equal parts of a strong solution of ammonia and of lard.

* * *Vegetable Substances.*

b. ACRID OIL.—This is the active vesicating agent in the following vegetable substances.

1. CROWSFOOT RANUNCULUS. *Ranunculus acris.* D.—WATER CROWSFOOT. *Ranunculus flammula.* D.—Both of these species of Ranunculus possess powerful vesicant properties. The first of them, the Ranunculus *acris**, or upright Meadow Crowsfoot, is

* Woodville's Med. Bot. 3rd. edition, p. 482, pl. 179. London Dispensatory, art. Ranunculus. Roque, 118. Lindley, 5.

an indigenous plant, belonging to the natural order Ranunculaceæ. It is a common weed in pastures, flowering in June and July. The root is creeping and horizontal, with numerous fibrils on the under surface: the stem is smooth, rises erect, to the height of two feet, branching into dichotomous or forked divisions, for supporting the flowers. The leaves spring from the root upon long petioles; are deeply divided into three divisions, and these again subdivided. The flowers are yellow, large, terminal, supported on smooth, petiolated footstalks, the calyx is spreading and hairy, and the petals display at the base of each an emarginate concave scale. The fresh leaves of this plant, when bruised and applied to the skin, rapidly inflame and blister.

The Ranunculus *flammula** is a still more acrid plant than the *acris*. It is a subaquatic plant, common in moist pastures, with hollow, branching stems, supporting ovate-lanceolate leaves. The flowers are yellow, numerous, small; and the fruit is a small cylindrical capital. All the parts of these plants are acrid; but they are most so just before the seeds ripen. The only disadvantage attending the employment of these plants as vesicants, is, that they lose much of their acrimony when dried. Another species, R. *sceleratus*, is more vesicant than either of the officinal species.

* * *Inorganic Substances.*

c. Ammonia.—When a piece of bibulous paper is soaked in strong solution of Ammonia, and applied upon the skin, it instantly raises a blister. It is employed in spasms and sudden attacks of inflammation of the thoracic or the abdominal viscera.

d. Nitrate of Silver. *Argenti Nitras.* L. E. D. (p. 605).—Although this substance is, strictly speaking, a chemical escharotic, yet it is also a vesicant when properly applied. For this purpose, the portion of the skin to be blistered is moistened, and a piece of the Nitrate passed over it, first across and then in the opposite direction, so that the whole of the moistened surface may feel the influence of the caustic, but not to an extent sufficient to produce a deep ulcer. In three or four hours a blister rises, the fluid of which is pus; and this being discharged by a puncture at the most depending part, no dressing is required. The advantage of this method of blistering over that by cantharides is the facility of the application, the rapidity with which the effect is produced, and the complete absence of general excitement, as no absorption of any kind takes place. It operates as a simple counterirrritant, and can be quickly repeated so as to renew and maintain the impression. I have found it admirably

* Woodville's Med. Bot. 3rd edition, p. 482, pl. 179. London Dispensatory, art. Ranunculus. Roque, 118. Lindley, 5.

adapted in pulmonary affections attended with much febrile excitement. Twenty of these blisters may be made over the surface of the thorax, in as many days, with the best effects. It is equally useful in diseases of the joints and deep-seated pains. The only caution required is moderation in the application: when too much of the Nitrate is rubbed on the part, the pain is excruciating, and its influence on the vascular system is sufficient to counteract any benefit which might result from its contra-stimulant property.

e. AQUEOUS STEAM.—Water cannot convey caloric to act as a stimulant under a temperature of 98°; but it is not until it arrives at 180° that it is rubefacient; and at 212° its vesicating property is instantaneously exerted. This effect is not altogether local, as demonstrated in scalds: it rouses generally the vascular system, quickening the pulse and producing febrile excitement. From the instantaneous manner in which the vesication is produced, the application of Steam might be very useful as a vesicant, if it could be conveniently employed. Various modes of applying water in the form of Steam have been suggested. The theory of its operation is evident. By the sudden conversion of Steam into water, much caloric is extricated. Water, when heated, expands like other bodies: this is moderate till the temperature be 212°, when the expansion is prodigious; but the Steam thus formed does not acquire any higher temperature than 212°; the additional caloric being rendered latent, and required for maintaining the gaseous form of the fluid. In returning, therefore, to the state of water, all this caloric again becomes free or sensible, and, by the law which regulates caloric, it must pass into the surrounding bodies. It has been calculated that 1000° of caloric enter water to convert it into Steam and maintain it in that state: hence the whole of this must be given out when water passes from the gaseous to the liquid state: and thus we have a vesicant power. One difficulty, however, attends the application of Steam; namely, that of limiting its action. Could it be applied by guarding every part around that which is to be blistered by substances which do not rapidly absorb or conduct caloric, all the advantages of vesication would be procured. Gout in the stomach, spasm, acute inflammation of the heart and pleura costalis, and, in fact, every deep-seated pain, might be benefited by its employment.

f. HEATED METAL.—This method of blistering was proposed by Sir Anthony Carlisle. It consists in applying to the skin a piece of polished metal heated in boiling water; it possesses one advantage over blistering by steam—its influence can be limited, and it is altogether more manageable. Any piece of polished metal, not too large, and sufficiently thick to retain the heat for a few seconds, will answer the purpose.

C. SUBSTANCES WHICH OPERATE AS ERODENTS OR SUPPURATIVES.

* *Organic Products.*

a. Acrid Oil forms the active principle of the following substances:

1. Bulb of the White Lily. *Lilii candidi bulbus.*—The beautiful plant which bears this bulb, although a native of the East, is now naturalized to this climate, and forms one of the most splendid ornaments of our gardens. It belongs to the natural order Liliaceæ*. The bulb consists of thick, fleshy, imbricated scales, which contain, in combination with much mucilage and starch, an acrid, volatile oil, on which its suppurative properties depend. The bruised bulb, macerated in fixed oil or in alcohol, yields up its acrid oil to these vehicles, which, applied to the skin, bring out a crop of pustules. It is now very rarely used.

2. Inner bark of the Mezereon. *Mezerei Daphnis cortex.* L.E.D.—This bark, and that of Daphne *Gnidium*, under the name of garou, have been, for many years, employed in France for maintaining the discharge from issues. They are in common use with the peasants of the Pays d'Aunis, and were made known to the profession by Dr. Le Roy in 1767. The peasants, from whom Le Roy borrowed this mode of using the Daphne, employed it as a vesicant, applying the soaked bark on the sound skin, covering the part with an ivy leaf, and renewing the application once in twenty-four hours. All the species of Daphne possess the same acrid inner bark, and are indiscriminately used for yielding the garou. It is prepared by soaking the branches in water and vinegar, raising the bark and separating the inner from the exterior layer. When dried and fit to be used, it has a fibrous texture, is of a pale green colour, has a faint, unpleasant odour, and a corrosive, acrid taste.

This acrid principle of the bark of Daphne is an alkaloid, which Vauquelin discovered, and which is known under the name of Daphnina.

The bark of the Mezereon has been employed as an Epispastic from time immemorial, in some parts of the Continent. If a small portion of the prepared inner bark be soaked in vinegar, and applied closely to the skin, it first reddens and inflames it, and, by repeating the application, a superficial suppurating sore or ulcer is slowly produced. It affects, however, the cuticle only, and does not form a deep ulceration or positive wound, although the discharge be considerable: the redness is, in extent, limited by the size of the covering, whether this be

* Woodville's Med. Bot. third edit. p. 743, pl. 254. Richard, Hist. Nat. Med. tome i, p. 350. Hayne, iii, 43. Lindley, 324.

an ivy leaf or a portion of oiled silk, which answers very well. Sometimes small phlegmons surround the ulcer thus made, and induce an almost insupportable itching; but this inconvenience is easily obviated by the application of a pledget of cold water over the part. A pommade or ointment of the expressed juice of the bark of the Daphne is also made for the purpose of dressing issues, and it is much preferable to the savine or any other ointment. It has one great advantage in particular over the savine ointment—it may be kept for any length of time without losing its effects. I am astonished that it has not been introduced into the British Pharmacopœias.

3. SAVINE CERATE. *Ceratum Sabinæ*. L. E. *Unguentum Sabinæ*. D.—This ointment is prepared from the Juniperus Sabinæ (see Emmenagogues), by mixing lb.i (lb. ss, D.) of the recent leaves, in lb. ss of wax and lb. ii of lard, melted together. The mixture may be either simply pressed through a linen cloth, or boiled until the leaves become crisp, as ordered by the Edinburgh and the Dublin Colleges. The former method is preferable, as the boiling dissipates a portion of the volatile oil, on which the acrimony of the cerate depends.

Savine Cerate is a common agent for maintaining the discharge from blistered surfaces. The powder of the leaves is employed on the Continent as an escharotic for destroying excrescences and cicatrizing syphilitic ulcers; but although these are the expressions of the French physicians, yet I cannot see any advantage that can result from the cicatrization of a venereal sore as long as the habit remains infected; and, when that ceases to be the case, the sore will heal without any difficulty. When the Savine Ointment is good and well prepared, it has a lively green colour, and the peculiar odour of the fresh plant. During its employment for maintaining the discharge of issues, it is requisite to remove, once in three or four days, a whitish coating which forms on the surface of the sore, and which impedes the influence of the ointment when it is not removed.

b. OLEO-RESINS operate as local excitants, causing deep-seated and most active phlegmonous inflammation, similar to those suppuratives which have been last noticed.

1. BURGUNDY PITCH. *Pix Abietina*. L. *Pix Burgundica*. E. D.—This is prepared by melting *Thus*, Common Frankincense, in hot water, and straining it through a coarse cloth. The Thus is an exudation from the Spruce Fir, Pinus *abies*, obtained by making incisions through the bark down to the wood. It flows thick and languidly, and concretes in flakes at the bottom of the incisions, adhering so firmly as to require to be separated by force. It is these flakes which, after being melted by boiling in water, and strained through cloths, constitute Burgundy Pitch. It has a terebinthinate taste and odour, is brittle, opaque, and of a light-fawn or reddish-yellow colour.

It is softened by a moderate heat, and is very tenacious. As a suppurative, its influence is slight; it produces a pimply eruption, which yields a purulent exudation, and causes much itching. Its chief excellence is its adhesiveness, which enables it to remain attached, and thus to maintain, for a considerable time, a moderately counterirritant effect. It has been found useful in chronic catarrh and dyspnœa.

Burgundy Pitch forms the bases of the following compound suppurative plasters:—

Plaster of Pitch. *Emplastrum Picis.* L. E.—According to the London College, it is made by melting together lb. ii of Burgundy Pitch; lb. i of Resin of the Spruce Fir; ℥iv each of Resin and of Wax; ʒi of expressed Oil of Nutmeg; f℥ii each of Olive Oil and of Water. The whole is boiled down to a proper consistence. The Edinburgh College orders lb. iss of Burgundy Pitch; ℥ii each of Resin and Bees-wax; ℥ss of Oil of Mace; fʒi of Olive Oil; and f℥i of Water. The Pitch, Resin, and Wax are melted with a gentle heat, and, the other ingredients being added, the whole is boiled down to a proper consistence. This plaster is more erodent, and consequently a more powerful counterirritant, than the simple Burgundy Pitch plaster.

Burgundy Pitch is also a useful and effective agent in the composition of the warming plaster, *Emplastrum calefaciens* of the Dublin Pharmacopœia.

Warming Plaster. *Emplastrum calefaciens.* D.—This plaster is made by melting together *one part* of the Plaster of Cantharides, and *seven parts* of Burgundy Pitch. In some habits it blisters; but, in these, this inconvenience is easily remedied by lessening the proportion of the blistering plaster. I have found it serviceable in those cases of dyspepsia which are connected with a state of subacute inflammation of the stomach. On account of the cantharides which it contains, strangury sometimes follows its use; hence it is contraindicated in cases of general excitement.

2. Compound Galbanum Plaster. *Emplastrum Galbani.* L. D. *Emplastrum Gummosum.* E.—Each of the British Colleges has a distinct formula for this plaster. The London College orders to take ℥viii of Galbanum; lb. iii of Plaster of Lead; ʒx of common Turpentine; and ℥iii of Resin of the Spruce Fir, powdered:—to add the Resin of the Spruce Fir, and then the Lead Plaster melted with a slow fire, to the Galbanum and Turpentine melted together, and to mix the whole.—The Edinburgh directs to take of Litharge plaster, ℥iv, Ammoniac, Galbanum, and Bees'-wax, of each ʒiv. Melt the gum-resins together, and strain them; melt also together the plaster and wax; add the former to the latter mixture, and mix the whole thoroughly.—The directions of the Dublin College are to melt lb.ss of Galbanum, and add to it lb. ii of Litharge Plaster, and ʒiv of Scrapings of

yellow Wax; then melt them together with a medium heat, and strain.

Although all of these plasters differ in their components, yet, all of them contain Galbanum; on the excitant influence of which their suppurative powers depend. They do not produce the same pustular eruption as the Burgundy pitch plasters; but their influence seems to extend deeper, and to stimulate the larger superficial vessels. They are generally employed to accelerate the suppuration of indolent scrofulous and encysted tumours, and also to impart action to the indurations which often remain around abscesses after they are discharged.

3. PLASTER OF AMMONIACUM. *Ammoniacum Emplastrum.* L. E. D.—This plaster is made by dissolving ℥v of Ammoniacum in f℥viii of distilled Vinegar (f℥ix of Vinegar of Squills, E., Oss, *wine measure,* D.), and evaporating the solution with a slow fire, or over a water bath, both to a proper consistence, constantly stirring during the evaporation. *Ammoniacum,* when dissolved in vinegar, and the solution inspissated by heat, forms also an excellent suppurative plaster, which does not produce pustules on the surface, but, like galbanum, stimulates deeply, and, consequently, aids the suppurative process in indolent swellings. In many instances, instead of forwarding suppuration, it favours resolution: hence, in combination with mercury, it is successfully employed to discuss indurated glands, nodes, tophi, and indolent tumours. The compound plaster is a useful excitant to indolent tumours.

CREASOTE. *Creasotum.* L. E.—This substance was discovered by Reichenbach, in 1830. In preparing it, Tar is distilled until white vapours begin to appear, at which time the distilled liquid is found to be divided into two distinct strata, the heaviest of which being neutralized with Carbonate of Potassa, the supernatant, and consequently the lightest, is distilled, and the first portions are rejected. An oily matter then comes over, which is agitated with dilute Phosphoric Acid, to remove some Ammonia that forms, and being redistilled from weak Phosphoric Acid, two substances, namely, Creasote and Eupion, are the result; the former of which is dissolved by agitation in Potassa, and thus easily separated from the latter. The solution of Creasote in Potassa is next decomposed by diluted Sulphuric acid, and the Creasote obtained tolerably pure by another distillation. Several repetitions, however, of the last part of the process are requisite to render it perfectly pure.

Pure Creasote is a limpid, colourless fluid, having a peculiar, penetrating odour, closely resembling that of Westphalia ham; impressing an acrid, almost burning, sensation upon the palate; and corroding the cuticle when rubbed upon it. Its sp. gr. is 1065; heat greatly augments its volume, nearly one-sixth, before it arrives at its boiling point, which is 397°. The strong mineral

acids decompose Creasote; the acetic merely dissolves it; and it is also soluble in the alkalies, alcohol, ether, the volatile and the fixed oils. It coagulates albumen, and reduces the oxide in Nitrate of Silver to the metallic state. According to Ettling, its constituents are $C.^{14}\ H.^{7}\ O.^{2}$, equiv. = 108·68.

Creasote, when topically applied, operates as an Erodent; but, unlike the other substances which irritate and erode the cuticle, its salutary effect is not the consequence of counter-irritation, but depends upon a narcotic and sedative influence, exerted upon the nerves of the part, and extended to the general system.

* * *Inorganic Substances.*

c. Acids.—When the mineral acids are combined with a moderate quantity of lard, the mixture operates as a suppurative, causing successive crops of pustules to appear on the skin.

a. Acetic Acid. *Aceticum Acidum.* L. E. D.—This acid, in its concentrated state, inflames and vesicates the sound skin. It consists of one atom of dry acid and one of water, when its sp. gr. is 1·06296, at 60° Faht. In a much weaker state, at 1·074, it instantaneously produces a blister. When still more diluted, it operates as an Erodent in removing warts and corns; but great care must be taken to prevent it from acting upon the sound skin. This vegetable acid, like the mineral acids, enters into chemical combination with the dead animal matter which forms the eschar.

* * * SALTS.

d. Tartar Emetic. *Antimonii Potassio-tartras.* L. E. D. (p. 749).—When a strong solution of Tartar Emetic, or an ointment containing it in the form of fine powder, or a plaster sprinkled over with its powder, or a strong solution of it, is applied to the skin, a vivid inflammation gradually succeeds, and a thick crop of large pustules, closely resembling the vaccine vesicles, in a few days rises upon the spot: these suppurate freely, terminate in crusts, which dry and are thrown off. In producing these effects, Tartar Emetic exerts no corroding influence on the cuticle; and, consequently, it is more or less effective according to the condition of the skin at the time of its application, and the mode of applying it. It has been judiciously recommended to excite the part before applying the Tartar Emetic, "either by friction with warm flannel, or a flesh brush, or by some stimulating application of a penetrating quality, such as camphorated spirit or strong vinegar." The sensibility of the skin being thus augmented, the Tartar Emetic, if immediately applied, instead of requiring two or three days to produce some large and scattered pustules, is often followed, in the course of a few hours,

with a thick crop of pustules, differing in size according to the strength of the application. If the ointment be employed, the best proportions are *two drachms* of Tartar Emetic in fine powder, *one drachm* of lump sugar, also in powder, and *six drachms* of simple ointment. The manner in which the ointment is applied varies much in its effect: thus, if the part be merely smeared with it, little more than a rubefacient effect is produced; if slight friction be employed, distinct pustules will follow; and if the friction be continued for fifteen or twenty minutes, and be pretty brisk, the speedy formation of a full crop of confluent pustules will be the result. If, instead of using the ointment, a solution of Tartar Emetic be preferred, the skin should be first rubbed with a piece of flannel, and then the solution applied as hot as it can be borne. The pustules are thus rapidly produced: they are small and numerous, and speedily heal, leaving no traces behind them; so that this method of applying Tartar Emetic is peculiarly adapted for females. If the powder of the Tartar Emetic be sprinkled on the common wax plaster, the result is much less certain than either of the methods of using it just described. In some instances, no effect whatever is produced; whilst in others a severe ulcerated surface is exposed on removing the plaster; and the pain attending it is often more than sufficient to counteract the intention of the suppuration by the excitement which is induced. By proper management of the ointment, a full pustular eruption may be almost always procured in five or six hours; and as its counterirritant influence is equal to, and more permanent than that of a blister, it is preferable to other suppuratives in many cases of deep-seated inflammations. The manner in which Tartar Emetic produces this effect is not well understood; neither can any satisfactory reason be given for its not stimulating equally the whole of the surface to which it is applied. It has occurred to me that the cuticle may be partially abraded by the friction applied either before or at the same time as the ointment, and the extreme vessels be thus affected in spots. One argument against this opinion might be brought forward—that the application of the solution of Tartar Emetic, if sufficiently strong, produces the same effect. Even in this case, however, the preparation partially affects the larger branches of the capillaries, and there the pustules may chiefly appear. I offer this opinion, however, as a mere hypothesis.

The application of Tartar Emetic as a suppurative, although not invented by Dr. Jenner, yet was introduced to the profession by that distinguished physician. It is now very generally employed as a counterirritant in all deep-seated pains and inflammations; and particularly in pulmonary inflammation. It does not always readily produce its pustular effect, owing to the greater density and less sensibility of the cuticle in some persons than in others. Suppurative inflammation, thus excited,

is a more permanent mode of producing counterirritation than blistering; and it may be employed with less hesitation than blistering by cantharides, as no absorption into the system takes place.

Some inconveniences are said to arise from the employment of Tartar Emetic as a suppurative—for instance, if it be taken into the habit, it produces sickness, particularly when applied to children*. Dr. Griffith, an American physician, published a case, in which he states that the Tartar Emetic ointment caused salivation; and Dr. Jackson, another American physician, has met with similar instances. With regard to the power of the Tartar Emetic ointment to produce sickness, I cannot deny the possibility of the case; but in a very extensive use of this ointment, I have never met with such a result. Some inconvenience, if the habit of the patient be very irritable, may result from continuing the application of this ointment after the pustules are fully formed. Ulceration takes place, and occasionally sloughing. If the application be continued after ulceration has supervened, symptoms resembling those that occur when arsenic is applied to an ulcer—namely, coma, feeble pulse, and paralysis—are apt to shew themselves. It also occasionally excites an irritation, sometimes very severe, of the genital organs, and the eruption extends over the whole body. These effects depend on the absorption of the Tartar Emetic from the abraded surface; a fact which is proved by testing the urine of a dog, poisoned by introducing Tartar Emetic into a wound. When the urine was dried, carbonized, and the charcoal submitted to the action of hydrochloric acid, diluted with one-fourth its weight of water, the filtered liquid, tested by Marsh's apparatus, afforded decided stains of antimony: and, treated by sulphuretted hydrogen, throws down sulphuret of antimony†. Tonelli, an Italian physician, formed an hypothesis that, independent of its irritant property, this ointment induces a specific effect on the lungs, owing to its abstraction of oxygen from the blood. It is unnecessary to make any comment on so visionary an opinion.

TARTAR EMETIC OINTMENT, *Unguentum Antimonii Potassio-Tartratis*, L. *Unguentum Antimoniale*, E. *Unguentum Tartari Emetici*, D. is made by rubbing into very fine powder, ℥i (ʒi, D.) of Tartar Emetic, and mixing it with ℥iv (℥i, D.) of Lard. A portion, the size of a small nut, should be rubbed on the part to be affected, night and morning, until pustules appear.

****** *Mechanical Means.***

e. ISSUES.—Any substance, calculated to cause mechanical irritation when introduced into a wound, is sufficient to form an Issue. The wound may be made by the knife of the surgeon,

* For a case where vomiting and griping pains followed its external application, see Journ. de Chim. Med. tome iv, page 478.

† Edin. Monthly Journ. of Med. Science, August, 1841, page 606.

or by the application of Potassa fusa or Nitrate of silver upon the skin. In the application of Potassa, it is necessary to limit its effect by defending the adjacent parts by a piece of adhesive plaster with a hole cut in it, over which the caustic is placed. When the eschar has separated, either the Curaçoa orange, Aurantium *Curassaventium*, or the common dried field pea, or a small portion of mezereon bark, is the best mechanical irritant introduced to maintain the discharge.

f. SETONS.—The lancet-bladed needle, threaded with a skein of silk, or the bistoury of the surgeon, is the agent for forming Setons. A portion of the skin is pinched up, and the instrument passed through it. If a skein of silk be not used, a tape of caoutchouc, or a stripe of sheet lead, may be introduced through the wound; and by shifting these daily, and occasionally smearing them with a little resin or savine ointment, the wound may be kept open and a discharge induced. The inflammation, at first, is often so considerable as to require to be moderated by the application of a poultice.

Issues and Setons, by exciting inflammation, attract a large supply of blood to the surface; and, as they also constitute drains, they are well adapted for relieving deep-seated inflammations and inordinate determinations of blood to internal organs. They prove occasionally salutaryin apoplexy, palsy, and similar affections; and, by their evacuant property, prevent injurious results from the drying up of old ulcers, or the repulsion of chronic cutaneous eruptions. On this account, Issues or Setons which have been long open should not be hastily dried up: they should be gradually diminished in size and depth, and, at the same time, a moderate contrastimulant effect maintained by means of purgatives.

MOXAS.—Their formation, and their mode of acting, will be given under the head of Escharotics.

THERAPEUTICAL USE OF EPISPASTICS.

Under this head, all the substances, whether they operate as Rubefacients, Vesicants, Erodents or Suppuratives, owe their curative influence to counterirritation; or, in other words, the production of artificial or secondary disease on the surface, to relieve a primary affection in some internal part. The practice of using them evidently originated in observing that the appearance of eruptions on the skin often relieved diseased conditions of internal organs. We know, also, from experience, that action, whether nervous or inflammatory, in one part, will often cease when action takes place or is set up in another. It constitutes what Dr. Parry terms "the relation of diseases by conversion*:" as far as respects Epispastics, by producing disease on the part on which they act, they relieve prior morbid affections.

* Elements of Pathology and Therapeutics, vol. i, § DCCCLX.

In *fevers of an intermittent character*, blisters have been applied to disturb the regularity of the paroxysm, and hence to cure the disease. Were it easy to calculate the period at which a blister would produce its full operation, in every state of the habit, we might be induced to rely upon its influence for restoring the balance of the circulation, which is evidently deranged, in the cold stage of ague: this, however, cannot be done; and blisters are, therefore, seldom employed for the cure of intermittents. If the effect of the blister depended solely upon the local stimulus which it induces, then those substances, such as ammonia and boiling water or steam, which raise an instantaneous blister, might be advantageously employed; but, as I am inclined to think that more is to be attributed to the general excitement of the habit than to the local stimulus, blistering by cantharides is preferable; and this is too uncertain, in the acme of its action, to be relied upon in agues. If blisters be employed, they should be applied before the commencement of the paroxysm, that their influence may be fully felt, and the train of morbid associations, constituting the paroxysm, be broken at its commencement. How much of the benefit is to be attributed to the pain of the blister arresting the attention of the patient, I cannot pretend to determine; but, as we know that intermittents are occasionally cured by the force of mental impressions, it is not unlikely that some of the benefit is due to the painful sensation excited by the rising of the blister. Upon the whole, however, I am of opinion that, in the range of remedies adapted for checking the paroxysm of intermittents, blisters are the least to be relied upon. In *continued fever*, the employment of blisters has been advocated and condemned by different writers of equal celebrity. If they are applied with the view of arresting the progress of the fever, the expectation of the practitioner will be disappointed: indeed, the irritation they produce is likely to increase the evil, if they be applied in the early stages of the disease, which are those of excitement. In the later stages of continued fever, however, when coma and delirium supervene, both sinapisms and other rubefacients, and blisters, may be prescribed with the fairest prospect of advantage. The delirium in fever is of two kinds: in one there is a preternatural or morbid determination of blood to the head: in the other there is that state which has been termed collapse; the pulse is weak, and the whole system debilitated. In both cases, blisters may prove beneficial: in the first case, they act as local stimulants, producing derivation or a transference of disease; in the other, they rouse the powers of the system by their general stimulant influence. When blisters are necessary for relieving coma, they should be applied to the shaved scalp: in very low states of the habit, however, rubefacients are to be preferred to blisters, as they are less likely to cause gangrene, and are nearly as beneficial in relieving local affections. In general, when rubefacients—for

instance, *mustard cataplasms*—are employed in typhus mitior, they are applied to the feet—a relic of the old doctrine of revulsion; but, like other local means, their utility is in proportion to their vicinity to the part affected. This is particularly to be kept in remembrance in those affections of certain organs—such, for instance, as the lungs, indicated by cough and oppressed breathing—which too frequently require the closest attention of the physician towards the close of fevers. In all cases where the abstraction of blood is necessary, the application of a blister should be delayed until after the bleeding, when the excitement has been diminished.

If we regard particular kinds of continued fevers, we find that practitioners in tropical climates recommend, strongly, the application of blisters to the pit of the stomach in yellow fever, under the idea that the stomach is the chief seat of the disease, inducing a malignant gastritis. "A prompt application of a large blister over the region of this viscus," says Dr. Chapman, "is obviously indicated, and all experience confirms its utility." The salutary influence of blisters applied to the head in the delirium of typhus is undoubted in those cases in which there is danger of the inflammatory action terminating in effusion. When the breathing is affected, it is more useful to apply them along the course of the spine; and in this case they should be of dimensions sufficient to stretch from the third cervical to the first lumbar vertebra. The best general rules for the application of blisters in continued fever are the following. 1. In that form of continued fever which is characterized by the early stages being inflammatory, they should be employed rather towards the conclusion than at the commencement of the disease: in typhus, on the contrary, rather at the beginning than at the close. 2. The evening is the best time for applying a blister, as it generally induces sleep when it begins to rise; and, were it applied during the day, the irritation which remains is likely to increase the evening exacerbation of the fever, and prevent sleep. But, although these are the general rules, yet the practitioner must be guided by circumstances: thus, great determinations to particular parts and spasmodic affections require the use of blisters in the decline of the disease; whilst the same symptoms occurring in the commencement, being commonly connected with the general state of the system, are more effectually removed by general means. The evening, however, under all circumstances, is the best period of the day for applying a blister.

In *symptomatic fevers*, in which there is a local inflammatory affection, the efficacy of blisters is undeniable. With regard to the proper time of applying them, as far as my own experience extends, I accord with those who think that they ought not to be employed until the general excitement has been reduced by blood-letting and evacuants. At a proper period of the disease—

that is, after the first or second bleeding—the application of a blister will often render farther venæsection unnecessary; and, certainly, when this can be effected, it is of the greatest importance, as the strength of the patient, which is rapidly reduced by repeated venæsections, is kept up, and the period of convalescence consequently shortened.

It was the custom of Huxham, and others prior to him, to apply blisters at a distance from the affected part—a practice founded on the theory of revulsion: but subsequent experience has demonstrated that they should be applied as near to the seat of pain as possible. When the inflammation is superficial, it is preferable not to apply the blister directly over the inflamed part; for two reasons—first, because local bleeding may be requisite after the blister has been applied, and therefore the affected part should be left free; and, secondly, because it has been ascertained that a large blister, applied at a small distance, has the same effect as a smaller one applied nearer to or directly upon the inflamed spot.

In *phrenitis*, the accompanying delirium rises to an exalted state: all stimulants become insupportable—light to the eyes, and sound to the ears. Tremors of the limbs, convulsions, coma, a sinking pulse, difficult deglutition and hiccup, occur, which are the forerunners of death. After the excitement has been reduced, it is usual to apply a blister over the shaved scalp. Now, although I would not attempt to impeach the propriety of this practice, after due evacuation, yet it is necessary to repeat what I have already stated, that cantharides are not the proper vesicants in phrenitis. If a counterirritant be requisite, a mustard cataplasm, applied over the shoulders, or an erodent, such as the tartar emetic ointment, or the actual cautery, when it can be applied, on the nape of the neck, or on the biceps humeri, will be found more advantageous than blistering by cantharides. To use the words of Dr. Burrows, speaking of the use of the tartarized antimony in mania—"This application might judiciously supersede cantharides, since it produces all their good, and none of their bad effects."

In *pneumonia*, blisters are applied; and they are found not only to diminish the cough, pain, and difficulty of breathing, but, by a transference of the inflammatory action to the surface, to promote the expectoration. The period proper for the application of blisters in this disease must be carefully attended to: the hardness of the pulse should be reduced, as well as the other symptoms, indicative of actual inflammation, diminished, before they can be safely applied. Physicians of equal celebrity have differed as to the precise time for their application: Sir John Pringle generally ordered a blister to be applied after the first bleeding; this was also the practice of Cullen; but Heberden and later practitioners have delayed the application of the blister

until after a second, sometimes even a third bleeding. At whatever period it is applied, it should be large, and placed exactly over the seat of pain. There is no necessity for allowing the blistering plaster to remain longer applied than is requisite for raising the blister; on the contrary, if cantharides be employed, disadvantages arise from the absorption of the cantharidin. The application of the blisters in pneumonic affections may be repeated as long as the symptoms of the disease continue; but, when these are obstinate, and time is thus obtained, the action of erodents, such as the cerate of potassio-tartrate of Antimony, is preferable to that of blistering. Some individuals, owing to a peculiar state of habit or idiosyncracy, cannot support the action of blisters of cantharides under any circumstances: in these the nitrate of silver is an excellant vesicant; or sinapisms and other rubefacients may be used. On these principles, our practice, as far as regards the employment of blisters in inflammatory affections of the chest, the fauces, the stomach, the alimentary canal, the liver, and the great intestines, should be regulated.

In *ophthalmia*, blisters are advantageously used after topical blood-letting. They are usually applied either on the temples or behind the ears. In the chronic form of the disease, I know of no class of remedies so serviceable as issues in the nape of the neck, kept freely discharging until the inflammatory affection has completely subsided, and the eyes have remained apparently well for some weeks. Aristotle informs us that the physicians of his time cauterized those afflicted with ophthalmia on the temples. I feel strongly disposed to recommend canterization behind the ears, or on the nape of the neck: for the radiation from the hot iron, when it is applied so near the eye as the temple, is, in my opinion, likely to injure that delicate organ.

In *gout* and *rheumatism*, the application of Epispastics, whether vesicants or rubefacients, is more problematical. "Blistering," Dr. Cullen remarks, "is a very effectual means of relieving and discussing a paroxysm of the gout, but has also frequently had the effect of rendering it retrocedent." I have little experience of the truth of this observation in gout, having scarcely ever ordered the application of Epispastics; but, in acute rheumatism, I have so frequently seen the most alarming translation of the inflammation to vital organs, that I cannot too strongly denounce their employment in this disease.

From the effects of the absorption of the acrid principle of cantharides, on the bladder and urethra, we should, a priori, be disposed to avoid the employment of blisters, raised by their means, in *nephritis*, or inflammation of the kidneys; yet, experience has fully demonstrated that such fears are fallacious, and that blistering plasters of cantharides may be safely and efficaciously employed in this complaint. In strangury, indeed, the irritation seems to be confined to the bladder and the urethra: it

is only when the pelvis of the kidney contains a calculus, or very coarse crystals of uric acid, that pain is felt in it. In one affection of the kidneys, that enlargement of the organ which is often the consequence of inflammation, Epispastics are of the utmost service. Upon the whole, blisters and other Epispastics are valuable remedies in the phlegmasiæ, with the exceptions which I have pointed out: but, at the same time, it must be admitted that symptoms in many cases may contraindicate their employment.

In *eruptive fevers*, blisters are decidedly less useful than in the phlegmasiæ. In *distinct small-pox* they are seldom required; and, except when local affections are present, nothing beneficial can be expected from them: on the contrary, when the excitement is high, they tend to increase the evil. It is after the commencement of the secondary fever that their aid may be required to recruit the strength and determine to the surface; and, when this is the case, or if local affections, such as cough, or pain in the right hypochondrium or the region of the liver, demand their application, they may be applied without any regard to the pustules with which the part is covered. One of the local affections which most unequivocally demand their employment is difficulty of breathing, arising from an unusual degree of swelling in the fauces, impeding deglutition. In such a case, a large blister, applied as near to the affected part as possible, is a remedy upon which the utmost confidence may be placed. In *confluent small-pox*, when there is a sinking of the pustules, and of the swelling of the face, without these symptoms being followed by swelling of the hands, some writers, particularly Dr. Brocklesby, have judiciously recommended the application of blisters to the wrists and fore arms; and the same practitioner recommends blistering the wrists, when the salivation which attends this form of the small-pox suddenly ceases without any swelling of the hands supervening. On the contrary, when the swelling of the face and the neck is excessive, applying sinapisms to the lower extremities often relieves it. In both forms of the disease, if convulsions appear during the eruptive fever, blisters are proper; and if, during the eruption, the pulse becomes feeble, blisters are useful to assist the languid powers of the constitution. The symptoms which in small-pox most decidedly demand the employment of blisters, are great anxiety at the precordia, coma, and delirium: under such circumstances, their use is unequivocally indicated, and they are employed with the greatest advantage.

In *measles*, blisters have been frequently applied, to recall, as it were, the eruption, when it has suddenly disappeared; but it has been correctly remarked, that this depends on a state of the disease in which blisters cannot be beneficial. They are, however, of use in relieving the cough, and particularly when pain of the chest indicates the presence of local inflammation.

In *erysipelas*, when it assumes the malignant character, the advantage of blisters has been established by the testimony of amplest experience; but since I have seen the extraordinary advantage which follows the use of the nitrate of silver, I never have ordered blistering in this disease. I employ a solution of ʒi of the nitrate in f℥i of distilled water, acidulated with m. viii of diluted nitric acid;—this is pencilled over the whole of the affected surface, whether simply inflamed or extensively vesicated, and allowed to dry on the part: it rapidly changes the morbid action of the capillaries into healthy action; and subdues the inflammation.

Blisters have been recommended in *scarlet fever*, when it assumes the typhoid type. I cannot affirm that my own experience has led me to place much confidence in their utility as a general stimulant in the low state of malignant scarlatina; although, as a topical application, when the throat is much affected, I have seen them successfully employed.

In *hæmorrhagic affections*, which, at least in their active state, resemble the phlegmasiæ, blisters have been sometimes found useful, particularly in bleeding from the nose and in vomitings of blood. In the former, they are to be applied to the nape of the neck; in the latter, to the pit of the stomach; but in both it is always requisite that bloodletting should precede the application of the blister.

In *dysentery*, and some other affections which consist of fever with augmented alvine excretions, the use of blisters is occasionally indicated.

In *leucorrhœa*, the morbid augmentation of the natural mucous secretion of the vagina is much diminished by their employment; and great advantage is derived from their application on the loins, over the pubis, and on the groins. In *gleet*, nearly equal advantage has resulted from their employment—an effect which might be anticipated, from their known influence on the urinary organs.

In *tubercular phthisis*, few means are so powerful as blistering, or the application of counterirritants, for relieving the cough and difficulty of breathing, and rendering the expectoration free. Vesication, indeed, has always been regarded as a remedy of general application in this complaint; the excitement, even at the commencement of phthisis, being seldom so great as to contraindicate its employment. It becomes, however, a question whether it is better to apply the plaster of cantharides, or nitrate of silver, or the tartar emetic ointment? I have had much experience of the effects of nitrate of silver; and what I have observed is altogether in its favour: the influence of the tartar emetic ointment is well known. Dr. Griffiths, an American, published a case in which that ointment produced salivation; and Dr. Jackson, another American physician, met with a similar

instance. If these statements can be relied upon, they confirm the opinion of its action upon the glandular system, from a partial absorption of the remedy; but this I doubt: its utility, as a counterirritant in tubercular phthisis is well known. It has one important advantage over vesicants and issues—it does not produce any considerable diminution of the strength; a circumstance which should be never lost sight of in prescribing for the relief of this formidable disease.

In the *Neuroses*, Epispastics, in every form, have been generally employed. In *apoplexy*, it is customary, immediately after full bleeding, both general and local, to apply blisters on or as near the head as possible. Cullen supposed that their utility depends "on their taking off the hæmorrhagic tendency" within the head: I would say that, after bloodletting has removed the impulse of the blood from the arteries of the brain, and this has also been aided by purging, blisters contribute to restore the healthy state of the circulation in that important organ. In applying blisters, or employing other Epispastics with this view, I have found them more beneficial when applied to the nape of the neck than upon the head; and the choice of this place is farther useful by leaving the scalp free for the application of evaporating lotions; or, what is still more suddenly beneficial, the pouring a stream of cold water upon the vertex while the patient is in a sitting posture. When the patient is old and feeble, and the strength cannot be relied upon under much venæsection, the use of blisters may occasionally preclude the necessity of a repetition of the bloodletting.

In that description of *paralysis* which Dr. Abercromby has so ably described as connected with a state of the brain, not apoplectic, but *inflammatory*, the discharge produced by vesicants and issues likely to prove more beneficial than in the ordinary apoplectic cases, in which an immediate and powerful counterirritant is required.

In *dyspeptic affections*, blisters are seldom resorted to; but, in my own practice, I have found both blisters and other Epispastics of the utmost benefit. The application of the emplastrum calefaciens, containing rather more cantharides than usual, or the tartar emetic ointment, is preferable to the ordinary blistering plaster for such cases; and I usually order them to be applied, after the abstraction of blood from the pit of the stomach, directly over the organ, a little towards the left side, so as to confine their operation as much as possible to the fundus of the stomach. I am of opinion that the cause of the acescent state of the contents of the stomach in dyspepsia is the hasty and consequently imperfect secretion of the gastric juice, owing to the very irritable state of that viscus. Now, alkaline remedies, administered to correct the acescent state of the stomach which always attends this complaint, do not benefit solely by their chemical union

with the free acid in the stomach: it is necessary, therefore, that the dose should be sufficiently large not only to neutralize the free acid, but also to leave uncombined a portion to act upon the irritability of the coats of the stomach, and, by diminishing this, to obtain a better gastric juice, more slowly and naturally secreted. That alkalies operate in this manner I was led to believe from knowing that, in irritable states of the urethra, in which a bougie cannot be carried on to the bladder, on account of the spasm induced by passing it into the irritable canal, we can, almost always, instantly effect our purpose by dipping the point of the bougie in a little liquor potassæ. It is upon this principle also that hydrocyanic acid produces its beneficial results in dyspepsia. To aid the operation of these internal remedies, an active warm plaster, applied over the pit of the stomach, after topical bleeding by cupping, proves most salutary. As soon as the pustules are fairly formed by this plaster, which occurs within forty hours after its application, the flatulence and acidity are found to be much abated; and, by continuing the application, and at the same time persisting in the use of the internal remedies, and regulating the operation of the bowels, yet, carefully avoiding purging, the disease yields more readily than to any other means. In this case, the Epispastic operates entirely by the counter-irritation which it induces overcoming, by its extent and degree, the irritation of the stomach.

In spasmodic affections, blisters are more or less employed. In *tetanus* they have generally been regarded hurtful; but if the view of the pathology of this affection, which I have been led to take from a close observation of its symptoms, be correct, I am satisfied that, although blisters from the action of cantharides may prove prejudicial, yet, Epispastics of another kind are the remedies most to be relied upon for relieving tetanus. When we consider that many of the leading symptoms of this affection closely resemble those of hydrophobia; that the respiratory muscles are equally affected; and that the most distressing symptom is the spasm which affects the diaphragm and mediastinum, occasioning the violent pain always felt at the lower point of the sternum, before the general rigidity and spasms occur—there is every reason for thinking that the motor tract of the spinal marrow is the principal seat of the diseased irritation. In hydrophobia, I am of opinion that the opposite column, or that giving off the nerves of sensation, is the part affected. Now, if this opinion be correct—and post-mortem examinations of the spinal marrow, both in tetanus and in hydrophobia, confirm the opinion—it must be obvious enough that a powerful counter-irritant on the surface, along the course of the spine, will afford the most rational prospect of success in any attempt to cure this disease. Dr. Chapman mentions a case of tetanus which occurred nearly half a century since, in the hands of a West Indian sur-

geon, a Mr. Cartar, which was effectually cured by the application of a strip of blistering plaster along the whole extent of the vertebral column; "and," Dr. Chapman adds, "this practice, I have heard, has been recently imitated, and with sufficient success to claim our attention." I may also quote Celsus in support of this practice: he says, speaking of the treatment of tetanus, when it is not relieved by cupping on the neck, "eadem aut ferramentis aut sinapi adurenda*." In a very severe case of tetanus, I acted upon this theory, and applied dry cupping, several times a day, along the course of the spine, in conjunction with calomel, purging, and opium, and succeeded in restoring my patient to health. This is one of the cases, in my opinion, in which moxas would prove highly beneficial, if applied sufficiently extensively along the spine. How far the same practice might prove useful in hydrophobia, I will not pretend to determine: the excessive sensibility of the skin, in this formidable and hitherto uncured disease, would make me pause before applying moxas. In all cases of spasm depending on or connected with internal irritation, which is not of a mere mechanical nature, Epispastics are likely to prove useful adjuncts, if they cannot be regarded as the principal remedies.

I have already noticed the impropriety of employing blisters formed of cantharides in *mania;* but moxas are beneficial in this disease. The ancients were in the habit of applying the actual cautery, as we learn from Celsus, who says, in treating of disorders of the head, "candentibus ferramentis, ubi dolor est, ulcera excitare;" and Reverius states that he cured mania by applying the hot iron to the coronal suture—a practice, however, which it is hazardous to follow. Erodents—as, for instance, the tartar emetic ointment—have been used to cause a derivation from the meninges of the brain to the surface; and, if we reflect upon the effect of the retrocession of cutaneous eruptions and their reappearance during cerebral diseases, we can readily imagine that the artifical formation of a crop of pustules upon the scalp will be likely to be followed by the best effects. In eighteen cases treated in this manner by Dr. Jenner, five were of insanity, and three of hypochondriasis closely approaching to it: of these, three recovered their intellects in a few days. Dr. Burrows states that his practice with the same erodent has not been so successful. In one case, however, when the habit was reduced to so low a condition that there was an appearance of mortification of the extremities, a warm plaster, intermixed with tartarized antimony, was placed over the shaved scalp. The patient soon recovered, without the extremities sloughing. Dr. Burrows speaks less favourably of setons and issues, and remarks that it is probable "that, where they have been reported to have

* De Medicina.

effected a cure, the malady has originated in metastasis, by the retrocession of some cutaneous eruption." "Whenever any of these causes," he adds, "are suspected of having influenced the mental disorder, a seton or issue should be introduced as near the head as convenient." He further adds, "Long-established setons and issues hastily dried up have caused many cerebral affections, and insanity among them."

It only remains to mention a few of the local diseases in which Epispastics have proved beneficial: these are strumous tumours, bronchocele, buboes, mammary swellings, and enlargement of the testicles. Applied behind the ears, they are useful in deafness, in painful inflammations of the membranous linings of the ear, in toothache, and in chronic ophthalmia. In acute and chronic inflammation of the joints, and in inflamed veins, phlebitis, their decisive utility has been well established.

Upon the whole, few remedies are of more importance or of more general use in the cure of diseases than Epispastics. Much judgment, however, is required in determining the circumstances of the habit, the period of the disease, and the situation in which they ought to be applied.

PART IV.

SECOND DIVISION.—CHEMICAL AGENTS.

Under the term *Chemical Agents* are comprehended those substances which influence the body or its contents by their chemical properties. In prefacing our examination of these, this question presents itself—What is the nature of chemical action? It may be defined—that action which is regulated by certain laws operating upon the ultimate particles of matter, and leading to the transmutation of bodies from one state to another, which phenomena depend on the attractions and repulsions exerted between these particles. The combinations which are the results of such affinities are constant and invariable, and may be predicted with certainty when the elements are placed under the same circumstances. Thus, if 54·15 parts or one equivalent of nitric acid and 47·15 or one equivalent of potassa be combined together, I can confidently predict that nitrate of potassa will be the result; or, if chlorine with sulphuretted hydrogen gas be mixed, that hydrochloric acid will be formed and sulphur deposited. But, when chemical agents are brought under the influence of the living principle, the affinities which produce these results are either modified or altogether resisted. Substances come into contact in the living animal system without undergoing any change, which, the moment life ceases, yield to the ordinary laws of chemical action, and decompositions and recombinations take place which could not have occurred during life. Some substances, nevertheless, have so powerful an affinity for the components of animal matter as to overcome the resisting influence of the vital principle, and effect new combinations with them. Others influence the body in a less direct manner, by uniting chemically with substances which are acting morbidly upon the nervous system, and changing healthy into diseased action. By their chemical union with these morbid matters, they form new compounds, which are either less active or which operate as sanitary agents. These are the substances comprehended under the term *Chemical Agents*. They exert their influence in three ways:—first, they affect the body directly and form new compounds with the constituents of its tissues; secondly, they affect it indirectly, combining, not with its organized tissues, but with the contents of the stomach, changing the properties of these; thirdly, they combine with and neutralize matters con-

tained in the atmosphere, which might, if left unaltered, produce injurious effects upon the animal frame. Chemical agents, therefore, in reference to their operation on the living system, may be divided into those which *act on the surface;* those which *act on the contents of the cavities;* and those which *change the state of the air:* the first comprehending *Escharotics;* the second *Antacids*, *Antalkalies*, and *Antilithics;* the third *Disinfectants*, or *Antiseptics*.

SECTION I.

CHEMICAL AGENTS WHICH ACT ON THE SURFACE OF THE BODY.

ESCHAROTICS.—MEDICAMENTA ESCHAROTICA*.

Syn. Cauterants.

Escharotics are "Substances which destroy the vitality of the part to which they are applied, and decompose the animal solid, forming a slough." In effecting this, they either combine chemically with the animal matter, destroying its organization and forming with it a soft pulp or species of slough; or, if they do not directly combine with the animal matter, they break the old affinities, causing the elements of the solid to enter into new combinations; whence, as Dr. Murray remarks, their cohesion is subverted and their composition is changed. In whatever manner this is effected, the life of the part is destroyed. The principal difference between the substances arranged under this order of remedies is the intensity of their action. Those which operate most powerfully, destroying the life of the part under all circumstances, independent of obvious chemical action, may be arranged under the head *actual Cauterants;* those which act with less energy, but solely chemically, *potential Cauterants*. Both may be employed with the same object in view, as far as regards their power of generally affecting the habit as counterirritants; but it is the second only, the *potential Cauterants*, that are most commonly preferred for this purpose.

TABLE OF ESCHAROTICS.

A. ACTUAL CAUTERANTS.

a.—Moxas.

b.—White-hot Iron.

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* From ἐσχέρα, an *eschar*.

B. POTENTIAL CAUTERANTS.

a.—MINERAL ACIDS.		
	Sulphuric Acid.	*Acidum Sulphuricum.*
	Nitric Acid.	*Acidum Nitricum.*
	Arsenious Acid.	*Acidum Arsenosum.*
b.—ALKALIES.		
	Potassa.	*Potassa.*
	Lime.	*Calx.*
	Potassa with Lime.	*Potassa cum Calcè.*
c.—METALLIC SALTS.		
	Nitrate of Silver.	*Argenti Nitras.*
	Chloride of Antimony.	*Antimonii Chloridum.*
	——— of Zinc.	*Zinci Chloridum.*
	Sulphate of Copper	*Cupri Sulphas.*
d.—REFINED SUGAR.		
e.—ALUM.		

ACTUAL CAUTERANTS.

CAUTERANTS comprehend all substances employed to cause disorganization of the part, for the purpose of forming and maintaining a suppurative discharge. Many substances may be used with this intention; but I will notice two only; namely, *Moxas* and the *white-hot iron*. I may preface my account of these with a few general remarks.

By the term *actual* cauterization, in contradistinction to *potential* cauterization, is meant the application of free caloric to a limited portion of the surface of the body. Potential Cauterants operate as chemical agents, destroying the life of the part by combining with its elements, and leaving the dead part to be slowly thrown off from the body by the vital powers of the surrounding parts. When *Actual Cauterants* are employed, the action of the caloric is confined to a limited portion of the body, as far as its destructive influence is exerted; and, beyond that, its stimulant influence rapidly rouses the energy of the surrounding parts to throw off the eschar, instead of paralyzing them, as is the case with some of the potential cauterants: the sloughing, therefore, takes place generally sooner than when the potential cautery is used. It is more beneficial than the potential cautery; and, were the application rendered less severe to the feelings of the patient, notwithstanding its formidable appearance, I am satisfied that it would be very generally adopted.

1. MOXA is a remedy of Chinese origin, and consists of small masses of combustible materials, which are burnt in contact with the skin, so as to form an eschar, more or less deep as cir-

cumstances may require. The Moxa employed by the Chinese is a cottony substance obtained from the leaves of a plant of the natural order Asteraceæ, the Artemisia *Sinensis*, or the A. *Moxa* of De Candolle. Both are perennial under shrubs, natives of China and Siberia. The leaves of A. *Moxa* are about an inch long; the lower ones bipinnated, the superior linear-lanceolate and obtuse, and all are tomentose. The flowers, which are borne on the summits of the twigs, are closely compacted in a simple, roundish or ovate, racemous panicle; the calyx is lax and woolly, the corolla smooth. The plant is inodorous, and has a bitter, aromatic taste. For the purposes of preparing Moxa, it is cut in June, early in the morning, whilst it is yet wet with dew: it is then hung up to dry in the free air, in a shady place. The *Moxa* is prepared by beating the dried tops and leaves of the plant in a mortar, until they resemble coarse tow: they are then, in this state, rubbed between the hands till all the fibrous and membranous parts of the leaves and stalks are separated; and what remains resembles very fine cotton, which is rolled up in the form of little cones or pastiles*. The Artemisia *Indica* and A. *vulgaris* are also prepared in a similar manner, and for the same purposes, in Japan and Java; and the Laplanders make Moxas of a fungous plant which grows in the fissures of old birch trees. As these *Moxas* cannot be readily procured in Europe, other materials have been employed for forming them, particularly by the French, who have used them more than almost any other nation. Baron Percy suggested to M. Robinet a method of forming them from the pith of the common Sunflower, Helianthus *annuus*, a substance which burns like touchwood; and the majority of the French Moxas are formed of a cylinder of this substance rolled in a piece of cotton. They are made of various sizes, according to the fancy of the surgeon who is to use them. Some are hollow cones, and burn more rapidly and intensely than the solid cones: they are, therefore, employed when a deeper issue than usual is required. In this country, Moxas are most commonly formed of cotton which has been steeped in nitre; sometimes of lint or fine linen which has been soaked in a filtered solution of chlorate of potassa, as recommended by Mr. Wallace†. But I have found that a piece of bibulous paper, moistened with the solution of Diacetate of Lead, dried, and rolled up as a cylinder, forms a better Moxa than either the Chinese or the French preparations. This Moxa burns regularly, rapidly, and leaves only a small portion of protoxide of lead as a residue.

The heat radiated from the Moxa causes much pain, and the inflammation extends some distance round the eschar, and also

* Thursberg's Voyages au Japan, iv, page 74.

† Physiological Enquiry respecting the Action of Moxa, &c. &c.

penetrates to a considerable depth, and establishes an effectual suppuration.

When the Moxa is to be used in gout, it is placed over the seat of pain. If the disease be paralysis, it is applied first over the origin of the nerves which go to the diseased parts, and afterwards along the same nerves in different portions of their course. According to the size of the Moxa, the mode of using it, and the nature of the combustion, whether spontaneous or aided by the blow-pipe, it causes either little obvious injury of texture, or it produces vesication, or it forms a slough. Employed with the first intention, the Moxa is not placed on the skin, but held in forceps as close to the affected part as the patient can bear, and moved closely backwards and forwards until the combustion be finished. To produce vesication, it is held steadily as close as possible to the skin without touching it, until the skin appear white, which is the indication of the cuticle being separated and a blister raised. Neither of these methods can, strictly speaking, be regarded as escharotic. To form a superficial eschar, the Moxa is placed on the skin, and allowed to remain until the spot near it appear brown, which generally occurs before the Moxa has burnt completely down to the skin. It is only for forming the deep ulcer that the combustion is allowed to be completed. The radiation of the heat, in this case, inflames the skin to some distance; and it is found red and wrinkled around a black spot produced by the combustion of the Moxa. When this is not desirable, the part should be covered with moist paper, with a hole cut in it large enough to admit the application of the Moxa. The eschar formed is deep; but it does not rapidly separate, sometimes requiring a fortnight for that purpose. The ulcer which follows discharges pus abundantly, and, by the aid of peas, it may be converted into an issue. When the intensity of heat is wished to be increased, the blow-pipe is employed, and the Moxa surrounded by a cylinder of card-paper, which both prevents it from being blown away, and also directs the current of heat downwards. If the pain after the operation be so intense as to be very uncomfortable to the patient, a few drops of ammonia, or some oil of turpentine; or alcohol, or ether, applied to the part by means of a hollow tube, will almost instantly moderate it. Baron Larry recommends this application of ammonia for allaying the pain, and remarks that it prevents inflammation—"the very effect," says Mr. Wallace, "which those who do not understand the application of Moxa are desirous of producing!" This gentleman maintains that, in the employment of Moxa, it should ever be our object to prevent inflammatory action. He conceives that the modus operandi of the Moxa is not the production of inflammation, but the application of a powerful stimulus to the capillary vessels, causing them to act with more force, to contract

their diameters, and consequently to circulate their blood with more velocity, and, either by means of this action on the capillaries, or a direct influence on the lymphatics of the part, to excite the functions of the absorbent vessels. He therefore concludes "that the action of Moxa on deep-seated disease is precisely similar to that which is exerted by some of our most valuable agents on superficial disease."

Be this as it may, it is difficult to conceive upon what grounds Mr. Wallace can maintain that Moxas, under at least three forms of their application, do not produce inflammation; for we cannot conceive the application of caloric to a part of the body, for a sufficient length of time or with an intensity capable of producing disorganization, without inflammation being the result. His hypothesis, however, explains the operation of Moxas when the texture of the skin is left undisturbed, by preventing the Moxa from touching the skin, and only moving it backwards and forwards over the part; but when the disorganization of the skin is actually effected by the combustion of the Moxa, I cannot avoid referring its beneficial effects to the same law of counterirritation to which the operation of vesicants and other powerful Epispastics undoubtedly must be referred. The manner in which the caloric is communicated to the part in the burning of a Moxa causes it to penetrate deeply; hence it is well adapted to make an impression on deep-seated inflammation; but, on this account, it should not be applied on parts where there is cartilage, tendon, or bone, or near the surface. Baron Larrey cautions against the application of Moxas to the parts of the cranium covered by skin and pericranium only, the eye-lids, nose, ears, larynx, over the tracheæ, glandular parts of the breast, linea alba, parts of generation, superficial tendons, articular prominences, over articular capsules, and the projecting points of bones. Gout, paralysis, neuralgia, spasmodic affections, and chronic affections of the joints, are much benefited by the application of Moxas.

2. White-hot Iron.—The employment of hot metal as a Cauterant was common among the Egyptian and the Greek physicians; but the use of it was neglected by the moderns until it again attracted the attention of the profession, by the success which resulted from it in the treatment of sciatica by Dr. Cotugna of Naples. Its principle of action is the same as that of Moxas, but more immediate and energetic, exciting the energies of the surrounding parts to a degree approaching to inflammation, with instant destruction of the part to which it is applied; on which account the slough is more rapidly thrown off than by the influence of any other Cauterant.

The stimulus which is thus communicated to the healthy parts is readily maintained by mechanical and chemical irritants, introduced into the ulcerated cavity; and these, causing a deter-

mination of blood to the part, operate in the same manner as suppuratives. But, in the first instance, the shock communicated to the nervous system by the application of so powerful an agent as the actual cautery is considerable; and, while we know that, in certain diseases, this is highly salutary, the knowledge of it is sufficient to guard us against its indiscriminate employment. A question may arise respecting the cause of the efficacy of Actual Cauterants—whether, like blisters, something be not due to the degree of pain which they excite diverting the attention from the seat of disease? In reply, it may be stated, that the effect is often produced before a degree of vascular action is set up sufficient to cause much pain; and that, in some cases, scarcely any pain follows, and yet a powerful change is effected in the habit.

The dread of the use of the white-hot iron is a great obstacle to its employment; but I have been enabled to obviate this, and also to lessen the pain attending its application, by guarding the surrounding parts with moistened paper, from which the water has been pressed, and in which a hole is cut, just large enough to admit the bulb of the cauterizing iron. By thus guarding against the influence of the radiation from the white-hot iron, the inflammation and vesication which attend the usual method of applying the hot-iron are avoided; and as the vitality of the part to which it is applied is instantly destroyed, little or no pain is experienced.

In a case of fungus, hæmatodes, which proceeded from the clavicle, and shot up as the cauliflower fungus, below the edge of the pectorales major muscle, the hot-iron not only destroyed the then existing fungoid tumor, but, by repeated applications afterwards, at distant intervals, it prevented the reappearance of it during the life of the individual, for two years. In sciatica, I have had every reason to be satisfied with its salutary effects.

In using the actual cautery, the following rules should be strictly observed.

1. Cover the surrounding skin to the extent of six or eight inches with moistened bibulous paper, from which all the water has been pressed; and perforate it with a hole the size of the bulb of the iron.
2. The iron should be *white*-hot.
3. Carry down the iron upon the part as rapidly as possible.
4. After the operation, apply liquor ammonia to the skin, round the burnt spot.

The use of Moxas was introduced into Europe as a local application in gout by the writings of Van Swieten; and to English practitioners more particularly by those of Sir William Temple, who had experienced the benefit of it in his own case. Free caloric, or the actual cautery, applied by the white-hot iron, was in common use among the Arabians for removing pains in various

parts of the body. The Chinese, Japanese, and many Asiatic nations, also employed free caloric as a remedial agent; but the hot iron was never used among these people, if we credit Kœmpfer. It was with them that the use of Moxas originated; and, according to Kœmpfer, they were so freely employed that sometimes the whole course of the spine was excoriated. The inhabitants of Lapland and Sweden apply Moxas in all internal pains, without external inflammation. I confess my doubts are considerable as to the beneficial effects of Moxas in gout, notwithstanding the authority of Hippocrates, who ordered them to be applied on the node of the joint of the finger: indeed, I should be cautious of the employment of free caloric in gout, however extricated, on the same principle which induces caution in the application of blisters. If Moxas, however, be at all advisable in gout, they should be employed according to the first method—that is, moving them over the pained part, at a certain distance from the skin, so as to exert their stimulant action only on the capillary vessels and on the lymphatics of the inflamed part. There is no rule, however, without exceptions; and, in atonic gout, a blister, and even Moxas, suited to produce a slight slough, instead of repelling the inflammatory part of the disease from the extremities, tends to fix it there; and, consequently, becomes not only highly serviceable, but even indispensably necessary. In the same manner as blisters are admirably adapted for aiding the cure of chronic rheumatism: and in sciatica, which so frequently resists every other remedy, Moxas have been found of the most decisive benefit. This is, indeed, the usual method of treating this form of rheumatism in many parts of the Continent, particularly in Russia. The Moxas, however, are required to be so often repeated, that I have been induced to apply the actual cautery, and have found that it is followed by the most permanent relief. Dr. Paillard has used phosphorus instead of Moxa, both in chronic inflammation of the joints and in inflammations of the abdominal viscera. He places a piece of phosphorus, half the size of a small pea, on the skin, and applies a hot wire to it. It acts rapidly and effectually. Dr. Paillard has applied thirty at once on the ham, in neuralgia.

A. POTENTIAL CAUTERANTS.

a. MINERAL ACIDS.

All the mineral acids, in a concentrated state, char and dissolve dead animal matter. This depends partly on their attraction for the water, which is one of the components of the animal fibre; partly on the partial decomposition of the acid itself: the animal tissues are thus disorganized, and acquire new properties, forming compounds which are dissolved in the undecomposed portion of the acid.

1. Sulphuric Acid. *Acidum Sulphuricum.* L. E. D.—This acid has a most powerful affinity for water; and it chars rapidly dead animal matter which is brought in contact with it, decomposing it, and itself undergoing decomposition. When the strong acid is applied to the living body, the vital energy is not sufficient to resist the attraction of the acid for moisture, and a soapy feeling is first experienced; but, in a very short time, as soon as the cuticle is dissolved, and the acid begins to act on the nerves, acute pain is experienced, the life of the part, however, is soon destroyed, and it becomes charred in the same manner as dead animal matter. As far as the action of the acid extends, until it becomes greatly diluted by distance from the point of application, this change in the structure of the part takes place; but there is no definite limit between the dead and the living parts, as when an actual cauterant is employed: an intermediate space exists, on which the action of the acid has not been sufficient to destroy vitality, but, nevertheless, has greatly weakened it; and hence a long period elapses before the dead part sloughs off. This is one of the disadvantages of employing Sulphuric Acid as an Escharotic; but greater inconvenience arises from its fluidity, and the impossibility of limiting its action to a particular spot. In consequence of these disadvantages, Sulphuric Acid is very seldom employed for the purpose of establishing an issue; but it is sometimes used for touching the surface of ulcers that have taken on an unhealthy character, with the view of inducing a change, and bringing back the ulcerated surface to the condition of a healthy, simple sore.

2. Nitric Acid. *Acidum Nitricum.* L. E. D.—This acid acts with more energy than the sulphuric acid on the dead animal fibre; it decomposes it rapidly, and is itself decomposed; nitric oxide and nitrous acid vapours being freely disengaged*. Applied to the living surface, it quickly destroys vitality; but the sphere of its action is less extensive than that of sulphuric acid; probably, in some degree, owing to its having less affinity for water than the sulphuric acid. It is never applied as an Escharotic to form an issue; but it has been advantageously employed in improving sloughing, phagedenic ulcers. When it is to be used, the surface of the ulcer should be well cleaned and dried; and, after applying a thick coating of lard to protect the surrounding sound skin, the whole sore must be touched with the acid by means of a sponge moistened with it, and pressed firmly down upon every part: in the course of a few

* When equal weights of muscle and nitric acid are heated together till the fluid boils, nitrogen and carbonic acid are evolved in a gaseous state, and the muscular fibre is partially converted into a fatty matter; and if skin, instead of muscular fibre, be employed, it is converted into fat and oxalic acid, whilst nitrogen and hydrocyanic acid are given over in a gaseous state.

hours the parts destroyed will be thrown off, and the sore will assume a more healthy aspect.

3. Arsenious Acid. *Acidum Arseniosum.* L. E. D.—This Acid has been more employed as an Escharotic than either of the two mineral acids just noticed. It was first introduced into use as a remedy for cancer; and various curious methods were adopted to obtund the violence of its action. Thus, Bayle recommends that it should be dulcified, as he terms the process of rendering it milder, by boiling alcohol over it several times. It was also applied mixed with sulphur and the powdered leaves of meadow crowsfoot, the Ranunculus *acris*, and dog's fennel, formed into a paste with yolk of egg, which was spread over the surface of the cancerous sore, and covered with a piece of bladder; in twenty-four hours a slough takes place, and, the coverings being removed and the part poulticed, suppuration is promoted. It has also been applied as an Escharotic in the form of ointment and solution. In the latter form it has been frequently employed, in the proportion of ten grains to an ounce of water; which is not, correctly speaking, a solution, but rather a mixture of the minutely divided acid in water. This is applied to the surface of the sore by means of a pencil. In treating of Arsenious Acid as a tonic, the hazard arising from its application to the surface of a sore was hinted: it is as dangerous as when taken into the stomach; vomiting and violent purging being induced, and fatal consequences have resulted. When death has ensued, the stomach and the intestines have been found extensively inflamed, proving the absorption of the Arsenious Acid into the system, and its peculiar determination to these viscera. Such facts are sufficient to demonstrate the impropriety of rashly applying Arsenious Acid to external wounds; and, when it is employed, the necessity of watching very closely its effects. It at all times causes violent, lancinating pains; so that no external indication of its injurious effects is afforded by that means. The moment it produces any nausea, or affects the breathing, then the external employment of it should be suspended. Notwithstanding these effects occasionally recurring, Arsenic has been advantageously employed as an Escharotic in scirrhus and cancer. It destroys the diseased surface, and, after the dead parts are thrown off, changes the morbid action of the vessels, causing them to secrete a healthy pus, and thereby promoting the healing of the wound. If poisonous effects are produced by it, the same plan of treatment must be adopted as if the remedy had been swallowed.

b. ALKALIES.

The Alkalies are much more frequently employed as Escharotics than the Acids.

1. Potassa. *Potassa.* L. E. D.—This substance is a hydrated oxide of Potassium, or, in other words, a compound of

Potassa and Water, one equivalent of the Potassa retaining one of Water. When pure hydrate of Potassa is fused in a silver or clean iron vessel, at a heat rather below redness, and is run into cylindrical moulds, it assumes somewhat of a crystalline character on cooling, and constitutes what is termed the *Potassa fusa*, the old *Lapis causticus*. When Potassa is rubbed up with dead animal matter, it immediately decomposes it, and a saponaceous compound results, whilst the alkali becomes a carbonate. On this account, Potassa was early employed to destroy fungous excrescences on the living body. It is said to be more capable of dissolving the animal solids than pure soda, and is therefore preferred to it for forming eschars for issues. It operates chemically by its powerful attraction for water, and its solvent property over albumen and gluten, forming with them new compounds, which in fact constitute the eschar. It is best applied by placing a small piece of it on the part where it is intended to act, and covering it with two or three folds of adhesive plaster. Its first effect is the partial deliquescence of the alkali, which next powerfully stimulates the sensibility of the part, exciting much pain, until the vitality of the spot be destroyed. It has one disadvantage depending on its deliquescent property—namely, it forms an irregular ulcer, and the eschar is very long of being detached. On the other hand, its action in point of violence can be easily controlled, by moistening the part with vinegar or any diluted acid when we wish to arrest its progress.

2. Lime. *Calx*. L. E. D.—This hydrate of the oxide of Calcium acts nearly in the same manner and with equal energy as the Potassa, destroying quickly the vitality of the part and entering into chemical union with the animal matter of the spot to which it is applied. It operates chiefly by withdrawing the water which forms a component part of all animal tissues. Although it is less apt to spread and extend irregularly its sphere of action than the potassa, yet it is much less employed, except as an addition to potassa, in the *Potassa cum calce* of the Pharmacopœias. The effect of lime in dissolving dead animal matter is so well known, that it has been used, from time immemorial, in dissolving the hair and gelatinous matters on skins, to fit them for the action of tannic acid in the preparation of leather. As an Escharotic, it produces more pain and general excitement than the pure alkalies.

a. METALLIC SALTS.

1. Nitrate of Silver. *Argenti Nitras*. L. E. D.—The influence of this preparation, as a vesicant, has already been noticed: it also operates as an Escharotic. The use of the Nitrate of Silver has been greatly extended, according to the plan suggested by Mr. Higginbotham of Nottingham. This gentleman found that, when the Nitrate of Silver is applied to a wound or an ulcer, by extending the application to a certain length beyond the edges of

the sore over the sound skin, it aids the rapid cicatrization of the sore. He also applied it in phlegmonous, erysipelous inflammation of the absorbents, and many other similar affections. In these cases, it is probable that much of the benefit depends on the formation, as he terms it, of the *adherent eschar*, which it forms of the cuticle or surface on which it acts. In ulcerations, there can be no doubt of the benefit likely to result from the formation of an artificial covering of the nature of this pellicle in protecting the irritable sore from the action of the air; and, by the gentle stimulus to the part, a more healthy action is produced, and the cicatrization is thus promoted.

2. SESQUICHLORIDE OF ANTIMONY. *Antimonii Sesquichloridum.*—This is the old Butter of Antimony of the shops. It is a transparent liquid, of a more or less yellow colour, varying in depth, owing to the presence of more or less Chloride of Iron. It emits fumes when exposed to the air, and displays an acid reaction. It is a compound of 1 eq. of Antimony = 64·6, + $1\frac{1}{2}$ of Chlorine = 53·13, equiv. = 117·73, or of 54·62 of Antimony, + 45·38 = 100·00.

This Sesquichloride is an energetic escharotic, yet causing little pain, and a rapid separation of the slough, leaving a clean, healthy surface. It is, however, seldom employed.

3. CHLORIDE OF ZINC. *Zinci Chloridum* has lately been much employed as an escharotic. It is easily prepared by dissolving Zinc in Hydrochloric acid, evaporating to dryness, and fusing. It is a soft, grey, or whitish-grey, semi-pellucid mass, fusible, and subliming in acicular crystals in a strong heat. It is very deliquescent; very soluble in water; and soluble also in alcohol and ether; and forms nearly insoluble compounds with gelatin and albumen. It is a compound of one equivalent of both its constituents (Ch. Z.) = 37·72; or 47 of Zinc, + 53 Chlorine, = 100.

This chloride operates as an efficient escharotic, destroying rapidly the tissues to which it is applied, and exciting powerfully all the surrounding parts. It causes much pain; but the slough is rapidly removed, and the sore displays a clean and healthy appearance. It has the same beneficial action in Cancer as the arsenical paste, without the danger of the constitutional mischief that sometimes follows the use of the arsenical preparations. It is much employed on the Continent; and has lately engaged the attention of British surgeons.

Chloride of Zinc, as an escharotic, may be applied in the form of a paste, made with one part of the Chloride, and from three to four parts of wheaten flour.

4. SULPHATE OF COPPER. *Cupri Sulphas.* L. E. D.—This salt operates as an astringent on dead animal matter, and as an Escharotic on the living body. It is more employed, however, as a powerful stimulant in giving energy to flabby, languid ulcers, than as an Escharotic.

d. Refined Sugar. *Saccharum purissimum.* L. E. D.— Refined Sugar is a compound of 42·1 parts of Carbon, + 6·4 of Hydrogen, + 51·5 of Oxygen, = 100·0; or ($C.^3 + H.^3\ O.^3$). Sprinkled upon spongy, irregular granulations, white Sugar operates as an escharotic; but there are so many better escharotics, that it is seldom employed for this purpose.

e. Alum. *Alumen.* L. E. D. — Alum does not display escharotic properties until it has been deprived of the water of crystallization, and has become the *Alumen exsiccatum* of the Pharmacopœias. It is not improbable that, in this state of Alum, some part of its escharotic influence is to be attributed to its attraction for the moisture of the animal tissue, and favouring the coagulation of the albumen. It is not much used, although it is well adapted for destroying granulations, and for giving a salutary impulse to languid and irritable ulcers.

The older physicians employed the Potential Cautery and Erodents very freely as counterirritants: Aetius extols their efficacy in asthma; Boerhaave and many others laud them in dropsies: it may indeed be said, generally, that they prove useful in all affections in which counterirritation is indicated, and where an immediate impression is not demanded. As an Escharotic, Boerhaave ordered the Potential Cautery to scirrhous glands —a practice which Heister properly condemns; and which is not devoid of danger when it is immediately followed by the use of the arsenious acid. With more propriety, Etmuller advised the Potential Cautery for removing polypi of the nose: but modern surgeons generally use the forceps for separating these parasitic tumours.

SECTION II.

ANTACIDS.—MEDICAMENTA ANTACIDA.

These require a very brief consideration. They are medicines which are said to obviate acidity in the stomach, by combining chemically with any superabundant acid there, and neutralizing it. In this point of view, they can be regarded as palliatives only, carrying off the acid already formed, but not preventing the formation of more: their utility, however, is not confined to their chemical action. I have had several opportunities of mentioning my opinions respecting the beneficial effects of alkaline substances in allaying the irritability of the stomach; and it is to this influence of Antacids that we are to ascribe much of the benefit derived from their employment in acidity of the primæ viæ. Their beneficial influence is not confined to their action on the stomach. The generation of much acid in that organ indicates a general diminished state of tone, with augmented irritability, and a condition of the system under which the formation of renal calculi is favoured and gout shews itself: by allaying this state, Antacids may be re-

garded as remedies of general influence, not only in these diseases, but in many others connected with an irritable and a dyspeptic condition of the stomach. The greater number of them are carried into the circulation; and it is consequently difficult to decide whether the beneficial influence, which they evidently exert, is to be ascribed to their chemical properties, or to their excitant influence on the glandular and capillary systems.

TABLE OF ANTACIDS.

a.—HYDRATES OF OXIDES.	
Lime Water.	*Calcis Aqua.*
Magnesia.	*Magnesia.*
Potassa.	*Potassa.*
b.—SALTS.	
Carbonate of Soda.	*Sodæ Carbonas.*
Carbonate of Potassa.	*Potassæ Carbonas.*
Bicarbonate of Potassa.	*Potassæ Bicarbonas.*
Solution of Ammonia.	*Ammoniæ Liquor.*
Sesquicarbonate of Ammonia.	*Ammoniæ Sesquicarbonas.*
Carbonate of Magnesia.	*Magnesiæ Carbonas.*
Chalk.	*Calcis Carbonas.*

A. SUBSTANCES WHICH OPERATE AS ANTACIDS.

a. HYDRATES OF OXIDES.

1. LIME WATER. *Calcis Aqua.* L. E. D.—This is an aqueous solution of Hydrate of Lime, or slacked lime. In the direction of the Dublin College for preparing it, boiling water, equal in weight to the lime, is ordered to be employed for slacking the lime; which is unnecessary, and forms a paste with the lime, that defends the interior from the action of the water. In the directions of the London and the Edinburgh Colleges, the lime is properly ordered to be first slacked by sprinkling over it a small quantity of cold water, and then to be agitated in a bottle with thirty times its weight of water; and the solution preserved on the lime for use. One grain only being taken up by 778 grains of the water at 60° Faht.; although this fluid, at 212°, requires 1270 parts to dissolve one grain of the hydrate. If the Lime Water be not used immediately after it is made, it ought to be kept in well-stopped bottles, to protect it from the air, which affords it carbonic acid, and converts the lime into an insoluble carbonate.

When Lime Water is employed as an Antacid, if we were to rely merely on its neutralizing property, the quantity required would be much greater than could be conveniently administered: but it merely tends to correct the lithic Acid diathesis. It is said, by Dr. Murray, to restore the tone of

the stomach, and to operate also as an astringent; but although lime corrugates the muscular fibre, and on that account is regarded as astringent and tonic, yet neither of these properties is very obvious in Lime Water; and, therefore, we must refer the benefit it produces in cases of acidity to its alkaline property of diminishing irritability, and favouring the secretion of a healthy gastric juice. It is frequently administered in milk, which covers its taste; but the propriety of employing this vehicle is questionable, because much of the lime is taken up in forming a saponaceous compound with the cream of the milk, by which its influence on the stomach is greatly lessened. The medium dose is from two to four ounces—quantities equivalent to one grain and a quarter and two grains and a half of the lime.

The soft *Carbonate of Lime*, or chalk, when mixed with or suspended in water, is a more powerful Antacid; but it does not allay the irritability of the stomach so effectually as lime water; and is uncomfortable, owing to the extraction of its carbonic acid in the stomach: it is, however, more serviceable when diarrhœa attends an acescent condition of the stomach. It is apt to form concretions in the intestinal canal.

2. MAGNESIA. *Magnesia.* L. E. *Magnesia usta.* D. (p. 864).—This hydrate has the advantage of lime water, from its forming a soluble and purgative salt with acid present in the stomach; but, whilst it does so, and thus carries off much of the already-existing acid, it does not allay the irritability of the stomach so effectually as lime water, unless it be combined with an aromatic. Such an union greatly augments the influence of Magnesia; and, in cases of violent vomitings, I have seen a teaspoonful or two of Magnesia, administered in a glass of sherry wine, produce a more immediate sedative influence than any other means that I have ever seen employed. But, besides operating as an antacid, in the ordinary acceptation of the term, Magnesia decomposes the lithate of ammonia, and uniting with the lithic acid, forms a very soluble lithate, which is excreted with the urine. The *Carbonate of Magnesia*, L. E. D. is also administered as an antacid in the diseases of children, as well as in an acescent state of the stomach in adults. The extrication of the carbonic acid has been regarded an objection; but, although that extrication of the acid is uncomfortable when much acid is present in the stomach in children, yet, in an adult, it is rather useful, as the gaseous acid stimulates the nerves of the stomach and acts as a tonic. The dose of pure Magnesia, as an antacid, should not exceed ℈i; that of the carbonate, ʒss. The carbonate may be administered in the form of lozenges.

LOZENGES OF MAGNESIA. *Trochisci Magnesiæ.* E.—Take ℥vi of Carbonate of Magnesia; ℥iii of pure Sugar; ℈i of Nutmeg: form the whole into a mass for Lozenges with tragacanth mucilage. They may be taken *ad libitum.*

3. SOLUTION OF POTASSA. *Potassæ Liquor.* L. *Potassæ*

Aqua. E. *Potassæ causticæ Aqua.* D. — This solution produces its effects as an Antacid both by neutralizing the existing acid, and by its powerful influence in allaying the morbid irritability of the viscus. Keeping these facts in view, there is little doubt that, in order to obtain all the advantages which the medicine can afford, it ought to be given in much larger doses than are usually prescribed. It is true that the pure alkalies operate powerfully on the living system, and this in proportion to their concentration: but, although a large dose of the Liquor Potassæ, taken into the stomach, even when much acid is present, if the habit be unaccustomed to the medicine, would undoubtedly prove injurious, yet, the system rapidly accommodates itself to very large does of this medicine; and its beneficial effects are rarely evident until full doses can be administered. I have carried the dose of Liquor Potassæ to the extent of 120 minims, administered three times in twenty-four hours, with the most decided benefit, in obstinate cases of psoriasis, and with the view of resolving anomalous tumours in the abdomen. It is necessary to mention that the medicine cannot be carried rapidly to this dose. When acid is present, its first effect is to neutralize it; much of the Potassa is thus rendered merely purgative; and it is only what is more than requisite for this purpose that can be said to exert its specific influence on the coats of the stomach. Potassa, however, as an Antacid, may be safely brought to the dose that I have mentioned; and, as it then enters the circulation and stimulates the whole glandular system, it not only acts as a palliative by its chemical properties, but also tends to correct the disposition to acescency. The best vehicle for administering it is the almond emulsion, unless we wish to combine it with a bitter, in which case the infusion of gentian, or that of orange-peel or cascarilla, will answer every indication that we can desire to fulfil with it; or, what is better than any of these, it may be given in beer. The dose at first is from fifteen to twenty minims; and it should be augmented, only five minims, at intervals of two or three days, until the full dose can be taken.

In weak stomachs, it is advisable to employ the carbonate of the alkali before using the pure alkali, as its action is not only milder, but, from the extrication of the carbonic acid, some advantage is obtained from its tonic influence, when applied to the sensitive nerves of the stomach, in the manner which must take place when this viscus is distended by it.

b. SALTS.

Some of these have been already noticed under the head of their alkaline bases: three only remain to be considered in this place.

1. Carbonate of Soda. *Sodæ Carbonas.* L. E. D. — This salt, as well as the bicarbonate, operates nearly in the same

manner as the Carbonate of Potassa; but it appears to be more readily taken into the habit than that salt. After a person has taken either of these carbonates for a short time, all the secretions, even the cutaneous perspiration, become very perceptibly alkaline. Its influence on the urinary secretion will be noticed under Antilithics. As an Antacid, its properties resemble those of the carbonate of potassa: it may be given in the same doses and in the same vehicles.

2. CARBONATE OF POTASSA. *Potassæ Carbonas.* L. *Potassæ Carbonas purum.* E. *Potassæ Carbonas e Tartari crystallis.* D. BICARBONATE OF POTASSA. *Potassæ Bicarbonas.* L. E. D.—The manner in which these salts operate, when taken into the stomach, has been already noticed under the head of the solution of the alkali. The Carbonate, owing to its deliquescent property, cannot be administered in substance; but the Bicarbonate may be given either in powder or in pills. The dose of saturated solution of the carbonate is from m. xx to f℥i; it may be taken in any bland, demulcent fluid.

3. SOLUTION OF AMMONIA. *Liquor Ammoniæ.* L. *Ammoniæ Aqua.* E. D. (p. 187).—Ammonia operates in the same manner as the other alkalies; but it communicates a powerful stimulus to the nerves of the stomach; and, from its volatility, readily acts on the acidity of the elastic vapour that frequently distends the stomach in dyspeptic affections. From fifteen to thirty minims of the Liquor Ammoniæ may be given in fifteen fluid drachms of any bland demulcent fluid that can cover the acrimony of the medicine whilst it is passing the gullet. The decoction of Iceland liverwort, Cetraria *Islandica*, deprived of a portion of its bitter, answers every purpose as a vehicle for the administration of Ammonia.

SESQUICARBONATE OF AMMONIA. *Ammoniæ Sesquicarbonas.* L. *Ammoniæ Carbonas.* E. D.—This Carbonate operates in the same manner, and is employed for the same purposes, as the solution of Ammonia. The dose, as an antacid, is gr. v to ℈i, in any bland, demulcent liquid.

From what has been said, it must be evident that this class of medicine is of very limited application.

SECTION III.

ANTALKALIES.—MEDICAMENTA ANTALKALINA.

FREE alkalies are never present in the stomach; but that there exists what may be termed an alkaline condition of habit, is well known. It is demonstrated in the chemical quality of the urine, accompanied with a pale countenance, lassitude, irregular bowels, sometimes costive, sometimes too relaxed, and a tendency to hysteria in females. Mental as well as corporeal causes; diseases affecting the spinal cord, whether in the loins,

back, or neck, or whether paralysis be present or absent, produce an alkaline state of habit, which is displayed in the urine. The *acids*, undoubtedly, are indicated in such cases: the best is the nitric acid, or the hydrochloric; and much benefit is derived from the employment of either.

SECTION IV.

ANTILITHICS*.—MEDICAMENTA ANTILITHICA.

Syn.—*Lithontriptics.*

The appellation Lithontriptics, generally applied to this class of medicines, is calculated to mislead, as it implies substances which dissolve urinary calculi; and, therefore, as I regard the substances in this class rather as *preventives* of the formation of calculous concretions than as *Lithontriptics*, or destroyers of concretions already existing in the kidney or in the bladder, I have chosen the term *Antilithics* as the name of the class. Antilithics may be defined—" Substances which counteract the predisposition to the formation of calculous concretions in the urinary organs."

I am of opinion that it has been too much the custom to regard the formation of calculi in the pelvis of the kidneys and in the urinary bladder as mere chemical processes, and, consequently, to conduct the treatment too exclusively upon chemical principles, losing sight of the general effects of disease upon so important a secretion as the urine. Dr. Marcet and Dr. Prout, to whose talents and industry the profession is more indebted than to any others for the lights which they have thrown upon this important subject, admit the truth of this remark. " The only benefit," says Dr. Marcet, " which we may with any confidence expect from medicine in this disease is either to prevent the increase of calculi already formed, or, what is still more important, to guard the constitution of those who are subject to the disorder against the prevalence of the particular diathesis from which it arises†." In accordance with the same views, Dr. Prout quotes an observation of Berzelius, that, in a case in which the phosphoric acid was indicated and was largely given, no effect was produced until it proved laxative, when " the urine became acid and deposited uric acid, which continued as long as the laxative effect continued, and no longer, although the dose remained unaltered‡." My own experience has amply confirmed this observation; and, also, another remark of Dr. Marcet, that alkaline remedies " often allay the irritation of the bladder and promote the flow of urine, even when, from the chemical composition of the concretions, they can be of no service as sol-

* From ἀντι, against, and λιθος, a stone.
† Marcet's Essay on Calculous Disorders, 8vo. 1817, p. 143.
‡ Prout's Inquiry into the Nature and Treatment of Gravel, Calculus, &c.

vents." Dr. Prout, also, in remarking that healthy urine is one of the most powerful solvents for urinary deposits, says that lithontriptics "are to be sought for among a class of harmless and unirritating compounds, the elements of which are so associated as to act at the same time, with respect to calculous ingredients, both as alkalies and acids*." A remarkable instance of the beneficial effects of general remedies—those which have no influence whatever on the calculus which excites the irritation—occurred to me some years since, and is a powerful illustration of the point under consideration. An elderly man, the master of the workhouse of the parish of Chelsea, placed himself under my care on account of a violent pain which he had experienced for several years across the loins, and which was accompanied with urine of a coffee colour and scanty in quantity. There was little difficulty in discovering the cause of these symptoms, and that the pain proceeded from irritation in the pelvis of the kidney, from the presence of a calculus. To combat the symptoms, under the supposition that at least the irregular surface of the calculus, which I suspected to be the chief source of irritation, might be smoothed by such chemical agents as were likely to pass to the kidneys unaltered, both acids and alkalies were alternately administered, without any advantage, although carried to full doses; and, after some months, symptoms of dropsy supervened. With the view of relieving the dropsical disease, diuretics—*foxglove* and *mercurials*—were administered until the mouth became affected. As soon as salivation supervened, the pain of the kidney abated, the urine remained clear, and every symptom of irritation disappeared and continued absent as long as it was requisite to keep up the mercurial action on the habit. On leaving off mercury, as soon as the mouth became well, the pain of the loins recurred, and, in a short time, the urine again became loaded with broken-down blood or the coffee-coloured sediment. For three years, circumstances required that the mercurials should be occasionally employed; and, in every instance, the beneficial effects were such as I have described. At length, during my absence in Scotland, my patient again lost ground: and, on my return, I found him in the last stage of dropsy, of which he died a few days afterwards. The post-mortem examination of the body confirmed my opinion of the disease; the pelvis of the right kidney was filled with an irregular-shaped calculus, which had assumed the form of the pelvis and its branching infundibula, and completely filled them, so as almost to prevent the passage of any urine into the ureter on that side of the body. I mention this case as a fair illustration of the effects of remedies not operating on chemical principles in allaying pain and clearing the urine, in a case all the symptoms of which so decidedly arose from the irritation of a calculus.

* On the Nature and Treatment of Stomach and Urinary Diseases, 1840.

Indeed, when we reflect upon the changes which disease effects on the urinary secretion, we shall be more and more convinced that the object of the *chemical* practitioner is, as Dr. Prout has expressed himself, "at best but of a secondary description; namely, to prevent the effects of disease, rather than to remove it."

In order to understand the manner in which Antilithics operate, it is necessary to enquire into some peculiarities connected with the secretion of urine, the evident intention of which is to carry out of the system effete animal matter, especially urea and uric acid, superfluous saline matter, and many soluble substances, connected with diet, which have entered the circulation.

The healthy urine of man is transparent, of a peculiar, somewhat violaceous or aromatic odour, and of an amber colour: its taste is bitter, and it has an acid reaction; but after a few days' exposure to the air, it becomes alkaline. Its sp. gr. is between 1·005 and 1·030.

Some of the saline matters contained in human urine are more liable than others to form deposits, owing to their comparatively little solubility; namely, the phosphates and the lithates. The former are held in solution by the phosphoric and lactic acids, which are always in excess in healthy urine; for when these, in concentrated urine, are saturated by a few drops of ammonia, the phosphates are precipitated: on the contrary, when any acid, in small quantity, is added to recent healthy urine, the lithates or the lithic acid, in small reddish crystals, are thrown down. Diseases operate nearly in the same manner in producing urinary deposits. Thus, in inflammatory diseases, we find the urine high-coloured, peculiarly acrid, and throwing down no deposit until the state of excitement begin to yield, when it lets fall a copious, pink-coloured sediment, consisting of the *rosacic* and *uric* acid, with a little phosphate of lime. The urine of those persons who labour under a gouty diathesis—that is, who are predisposed to gout—contain much less phosphoric acid than that of healthy individuals, and even although the quantity of this acid is increased during the actual presence of the gouty paroxysm; yet it is much less at this time, than is usual in healthy urine. This is also the case in rheumatism; and, as in other inflammatory and irritable diseases, in the decline of the paroxysms of which there is a copious deposition of pink sediment, which Dr. Prout regards as urate of ammonia coloured by purpurate of ammonia: but the idea of the colouring matter being purpuric acid is denied by Messrs. Brett and Bird*. In healthy urine, the phosphates are in small quantity; but, in derangements of the chylopoetic viscera and in low states of the habit, it is from the abundance of these compounds that calculi, both in the bladder and in the kidneys, are formed.

In dropsy, originating from disease of the kidneys, the urine is loaded with albumen and becomes milky, coagulating when it

* Med. Gazette, 23rd August, 1834.

is heated, or when acids are added to it; but, if the dropsy be connected with diseased liver, the urine is scanty, high-coloured, and entirely free from albumen. It is probable that the nitrogen, which exists in albumen to the amount of fifteen per cent. is exhausted in the formation of the lithic acid in these diseases; this acid requiring nitrogen as one of its components: hence the necessity of a vegetable diet in such cases.

Urea, in its pure state, is in delicate, silvery, nearly transparent, four-sided, colourless or pearly-coloured prisms, soluble in their own weight of water at 60°, but requiring five times their weight of alcohol for their solution. It displays neither an acid nor an alkaline reaction; is inodorous, and impresses a cooling sensation, like nitre, on the palate. It is a principle peculiar to urine, depending probably, as Dr. Prout has suggested, upon the action of the kidneys on the albuminous matter of the blood: its ultimate constituents are, according to Dr. Prout, 46·67 of nitrogen, + 19·97 of carbon, + 6·65 of hydrogen, + 26·65 of oxygen, = 100·00;—or, 4 eq. of hydrogen = 1, × 2 of carbon = 12·24, + 2 of oxygen = 16, + 2 of nitrogen = 28·24; making the equivalent of the salt 60·24. In some diseases, as will be presently noticed, no urea is present in the urine.

Lithic or *uric acid*, when pure, is obtained in the form of small white scales; when impure, these are yellow or brownish. They are inodorous, insipid, have an acid reaction, require 10·000 times their weight of water at 60° for their solution; and are insoluble in alcohol and ether. Warm urine often holds in solution more lithic acid than it can retain when cold, and consequently it is precipitated as the urine cools, usually of a pink or rose colour, sometimes it is crystallized and brick red, this colour being due to a colouring matter which combines with it*. It is a compound of the same constituents as urea, but in different proportions; namely, 31·12 of nitrogen, + 39·87 of carbon, + 2·22 of hydrogen, + 26·77 of oxygen, = 100·00; or, 2 eq. of hydrogen, + 5 of carbon, + 3 of oxygen, + 2 of nitrogen; making the equivalent 84·90; but, if this contains 2 parts of water, as has been asserted, the equivalent of the anhydrous acid is 66·90. Dr. Prout is of opinion that it is always in combination with ammonia, as a lithate or urate, in urine. Pure uric acid is white, inodorous, tasteless: it is sparingly soluble in water, and wholly so in alcohol. It forms salts with alkalies. Nitric acid gives it a purple colour. Urine contains other acids, namely, the Purpuric and the Rosacic.

Lactic Acid is formed by the spontaneous decomposition of animal matters in the body, and is carried out of the system in the urine, of which it is the chief cause of its acid reaction. *Carbonic Acid* is, also, sometimes present in urine. *Silicic Acid*

* Müller's Elements, trans. vol. i, p. 634.

is always present, and is supposed to be derived from the water, which is used as beverage.

In *hysteria*, the urine is in large quantity, limpid, colourless, and containing scarcely any or no urea; and, in *chronic hepatitis*, it is almost totally devoid of it, but contains much albumen*. In gout, the concretions are chiefly urate of soda and of lime; and the urine contains a large proportion of lithic acid, although during the paroxysm it is free from it. In *rickets*, the urine is loaded with phosphate of lime; in *diabetes*, with saccharine matter; in *dyspepsia*, it contains so much gelatin that it yields a copious precipitate with tannic acid; and in *anasarca*, and *degeneration of the kidneys*, it is deficient in urea, but loaded with albumen.

The conclusion to which these observations lead is this—that, when the urine displays such variations of chemical character from the effects of disease, and when these chemical changes are removed, not by any agents directed to effect chemical action on the secretion itself, but by general remedies directed to fulfil the indications which these states of disease present—there is every reason for not confining our attention, in the treatment of calculous diseases, too exclusively either to the chemical constitution of the urine, or that of the calculous concretions deposited from it. In making these remarks, it is not my intention to take too limited a view of what may be termed the calculous diathesis and its treatment: nor is there any occasion to detract from the great advantages which have been derived from chemistry in this branch of therapeutics. Without a clear understanding of the chemical nature of urinary calculi, we should be but ill fitted for affording relief, even in taking a simple pathological view of the cases that, daily, are brought under our notice.

In treating of diuretics, I noticed the components of urine, as obtained by the analysis of Berzelius; it is therefore now only necessary to mention that its chief components are, besides *water*, *urea*, *lithic acid*, *free lactic acids*, and *lactates*, *sulphates of potassa* and *soda*, *phosphate of soda*, and *biphosphate of ammonia*, *chloride of sodium*, and *hydrochlorate of ammonia*, some earthy *phosphates*, and *silicic acid*. In stomachic diseases, the more or less assimilating quality of the food, and the nature of it, favours either the production of the lithates, the phosphates, and other compound salts, and calculi are the result. The following is the nature of the four kinds of calculi, under which all the others may be arranged:

1. The *Lithic Acid Calculus* is of flattish-oval figure, brownish-red or fawn-coloured, surface smooth, or finely tuberculated, and composed of concentric laminæ, or at least the texture is laminated. It is inodorous; soluble in pure alkalies, but not in their carbonates; sparingly in water; insoluble in sulphuric and hydro-

* Mukel's Arch. ii, p. 642.

chloric acids; but soluble in the nitric, and, on evaporating the solution to dryness, a bright pink residue is left. The Lithic Calculus blackens and evaporates before the blow-pipe, leaving a white alkaline ash. A variety of this species is the urate of Ammonia calculus; it is distinguished by its clay colour, its greater solubility in boiling water than the lithic acid calculus; and the disengagement of Ammonia during its solution in pure potassa. It is probable that all lithic calculi originate in the kidney, and drop down into the bladder after they have attained much magnitude, becoming there the nuclii of stones. The lithic acid calculi are the most common species of calculus; but the urate of ammonia is rare, and found only in children and young persons.

2. *Mulberry Calculus* is of a dark-brown colour, the surface tuberculated, the substance hard, and the texture imperfectly laminated. It is usually globular, but seldom large, and it consists chiefly of oxalate of lime. In fine powder, it is soluble in hydrochloric and nitric acids; but not in the pure alkalies. When Mulberry Culculi are exposed to heat, the oxalic acid is volatilized, and quick lime remains. Some have no tuberculated surface, but are smooth, as illustrated in what is called the *hemp-seed* calculus, which is of a pale colour, and always of a small size.

3. *Phosphate of Lime Calculus* has a pale-brown colour; a surface smooth, as if polished; the texture is laminated, so as to separate into concentric crusts; it is commonly of an oval shape, and large. In fine powder, it dissolves in nitric and hydrochloric acid: but it is insoluble in potassa. It is fused in an intense heat. It is the result of an alkaline state of the urine.

4. *Ammoniaco-Magnesian Phosphate Calculus* is almost bright white, it is little compact, and the surface is studded with minute crystals. It is soft, and easily pulverized, although it has been found hard and crystallized in the interior. Before the blow-pipe it gives out an ammoniacal odour, and then fuses. The crystals are sparingly soluble in water, but readily in the acids, even the acetic. Pure potassa disengages ammonia from them; but does not dissolve them. It is a rare species of calculus, except in the form of what is termed the *fusible calculus*, in which the Ammonia-phosphate of Magnesia is combined with phosphate of lime. It occurs when the urine becomes charged with ammonia, as in spinal affections. It is the whitish and most friable of all the calculi, soiling the fingers like chalk: when the texture is laminated, the layers are often studded with crystals of the triple phosphates. Fusible calculi often acquire a great size.

5. *Carbonate of Lime Calculus* is white and very fusible; it usually contains some phosphate of lime. It is rare; and is easily recognized by its effervescing with hydrochloric acid; and the solution being abundantly precipitated by Oxalate of Ammonia.

There are, besides these, others, which are termed *cystic*, *xanthic*, *alternating*, and *compound calculi*; but they are very rare.

In treating of the class of medicines supposed to act on these calculi, we must regard those articles contained in it in two points of view:—1st. As fitted for removing the symptoms that indicate the first formation of calculous deposits in the habit; and these I would regard as *Antilithics,* or preventives of stone. 2dly. As fitted to act upon calculi already existing in the kidney or in the urinary bladder; and, by wearing down or smoothing their asperities, to diminish their irritating powers, if they cannot altogether dissolve them; and these I would denominate *Lithontriptics,* or solvents of calculi. There can be no doubt that the first part of our enquiry is the most important, and that likely to prove practically useful. It has been said that solvent medicines, or Lithontriptics, prove also serviceable: I would say, that it is in the early stage of the disease that the accumulation of calculous matter is likely to be prevented; and that the plan of treatment should be begun so early after the first symptoms display themselves, that the gravel or calculous matter deposited shall be readily washed out by the urine. This question then presents itself—what are these symptoms? and it is followed by another—what are the *Antilithics,* and in what manner do they operate to effect the changes which are desired?

There are three substances which principally form the gravel and calculous matter deposited in the urine; *uric acid, phosphate of lime,* and *phosphate of ammonia* and *magnesia:* and it is of great importance to be aware of the first indication of these in the urine, in quantity sufficient to afford deposits.

Whatever generates free acid in the stomach, or causes a dyspeptic state of the stomach, favours the deposition of *lithic* or *uric acid,* the existence of which is well known by the name of red gravel; it is the disease, therefore, of dyspeptics, especially those of a gouty diathesis, when this is attended with a dry state of skin; this acid being, in a healthy condition of the habit, freely thrown off by the cutaneous exhalants. Two thirds of the calculi generated in the kidney consist of this acid. The opposite state of the system, when there is a deficiency of acid in the urine, or whatever can give it an ammoniacal character, favours the deposition of the phosphates: the stomach is generally deranged; and when the bladder has lost any of its muscular energy, as in cases of disease of the prostate, in affections of the spine, and in very old people, the urine is so long retained in the bladder as to undergo a partial decomposition, ammonia is generated, and a deposition of the ammoniaco-magnesian phosphates takes place. This is also the case when the alkalies are administered in this state of the habit; and a disposition to stone of the bladder is favoured. It thus appears that these two deposits at least are wholly influenced by the general health. But whatever may be the cause of urinary deposits, the knowledge of their nature teaches us the necessity of varying our means according as they are of an acid, an alkaline,

or a mixed character. It is not our object to investigate closely the symptoms that indicate the presence of calculi in the kidneys, where they all are first deposited. The most common are a sensation of weight and aching in the loins; occasionally a pain at the scrobiculus cordis, numbness, cramp, pain or œdema of the thigh on the side of the affected kidney; and either bloody urine, or a deposit resembling coffee grounds. Inflammation is less frequent than might be supposed; on the contrary, the pulse is quiet and regular; unless the calculus is finding its way from the pelvis of the kidney to the bladder. Much mucus is generally passed with the urine. The continued general irritation of the nervous system, and the local injury to the urinary organs, causes what has been termed the phosphatic diathesis, and a breaking down of the constitution. The following are the *Antilithics* most likely to obviate these symptoms.

TABLE OF ANTILITHICS.

A. ——— when an Acid is indicated.

a.—Mineral Acids.
- Sulphuric Acid,
- Hydrochloric Acid.

b.—Vegetable Acids.
- Tartaric Acid,
- Citric Acid,
- Carbonic Acid,
- Benzoic Acid.

B. ——— when an Alkali is indicated.

c.—Oxides.
- Solution of Potassa,
- Magnesia,
- Lime Water.

d.—Salts.
- Carbonate of Potassa,
- Carbonate of Soda.

C. ——— when Tonics are indicated.

e.—Vegetable Bitters.

f.—Vegetable Astringents.

D. ——— when Lithontriptics are indicated.

g.—Acids.

h.—Alkalies.

SUBSTANCES WHICH OPERATE AS ANTILITHICS.

a. ACIDS.

Before entering upon the consideration of the efficacy of particular acids as Antilithics, this question presents itself for consideration—Are acids carried to the urinary organs through the circulation? The free acid generally present in the urine renders it difficult to satisfy the mind upon this point. It has been ascertained that sulphuric acid enters the circulation; for, in the case of a pregnant female who was poisoned with it, and gave birth to a child in the expiring throes of life, sulphuric acid was detected both in the body of the infant and in the liquor amnii. The experiments of Mr. Brande* also render it at least probable that carbonic acid reaches the bladder.

Whenever the quantity of the natural acids of urine is diminished below a certain point, we find that white sand is deposited. The cause of this deposit is generally some disordered condition of the digestive organs. The occasional appearance of it is of little consequence, if it occur only after irregularities in diet; but if it appear daily, and after ordinary temperate meals, and particularly if it be voidable in a visible state in the urine, and do not simply appear as a deposit, on the cooling of the fluid, then it ought to obtain our serious attention. It more easily collects and forms into calculus, which is either voided, or is displayed as deposits; and these are peculiarly favoured, if, from stricture of the urethra, or any other cause, the bladder be not completely evacuated when the urine is passed. Remedies, in such cases, ought to be immediately resorted to; and, as this *white* sand consists of the phospates, ACIDS are indicated.

1. MINERAL ACIDS.—All of these have been employed in cases depositing white sand: but the *nitric* has been supposed to disagree with some stomachs, exciting flatulency and eructations, and therefore it is seldom used. The objection, however, is not valid; for I have given it in large doses; and Sir B. Brodie has carried it to the extent of f℥i in the day without inconvenience; at all events, this objection cannot be brought against the *sulphuric* and *hydrochloric:* either may be employed for adults. The *hydrochloric acid* acts more upon the bowels; and, as an open state of these always tends to relieve the condition of the habit which encourages the deposition of the phosphates, it is to be preferred to either of the other mineral acids. When it agrees with the stomach, this *acid* soon diminishes this deposit of the phosphates, or, more correctly speaking, prevents its further formation. Many persons who suffer from acidity of stomach can take hydrochloric acid with impunity. The dose of the acid

* Philosophical Transactions, 1808, p. 242.

is from ten minims to twenty, or even fifty, in any mucilaginous fluid; but, after its influence is experienced, the dose should be diminished; and, if any uric acid appear, the use of the mineral acid should be altogether intermitted. These remarks apply particularly to adults; for, in the cases of children, the vegetable acids are always to be preferred.

2. Vegetable Acids.—It is probable that the Vegetable Acids undergo decomposition during the process of assimilation, or, as it is termed, in transitu; and, as in this state new compounds are formed, it is difficult to predicate whether these are likely to prove salutary or prejudicial. The *tartaric acid* has not been much employed; but if we regard it simply as an Antilithic, operating on the stomach, it is as likely as any other to prove beneficial. An excellent method of administering it to children, is in the form of imperial, made with the bitartrate of potassa, which has also the advantage of keeping the bowels in a soluble state. But it must be recollected that the bitartrate of potassa is one of those salts which, when taken for some time, is supposed by Dr. Paris to be decomposed in the stomach, and to afford its alkaline principle only to the kidneys. When treating of this salt as a diuretic (p. 1002), I pointed out the probable fallacy of this opinion; as, the moment its superabundant acid is consumed by the digestive process, the tartrrate thus formed will act on the bowels, and carry itself out of the habit; and I have no doubt that the purgative effect of the bitartrate is, probably on every occasion, owing to this change. The dose of the tartaric acid as an antilithic is gr. v to gr. xv.

Mr. Brande, in his observations "On the Medico-Chemical Treatment of Calculous Diseases," states his preference for the *Citric Acid*, which may be given in doses of from gr. v to ʒss; and it has the advantage of being highly relished by children.

It is extremely probable that much of the benefit arising from these acids proceeds from their action on the digestive organs, correcting irregularities of these organs, and particularly of the liver, in those persons who pass the *ammoniaco-magnesian phospates;* but it is also probable that they partly find their way to the kidneys and bladder, as they have proved useful in relieving those cases of elderly persons, who, from some affection of the urethra, or from the disability of completely evacuating the bladder, have a tendency to the accumulation of ths phosphates in that viscus. This idea of the penetration of acids to the bladder was particularly believed in reference to carbonic acid, before the nature of urinary calculi was understood: hence any reasoning upon its action must necessarily be very imperfect; and, from the experiments of Dr. Marcet*, the passage of carbonic acid from the stomach into

* Marcet on Calculous Disorders, 8vo. p. 160.

the urine is very improbable. On the other hand, we know that the tonic influence of carbonic acid, when applied to the nerves of the stomach, independent of any chemical agency, is great; and therefore its influence as an Antilithic may depend on this property.

b. ALKALIES.

The *Alkalies,* it is almost unnecessary to remark, are to be employed in the opposite condition of the system from that indicating the use of acids; that is, when there are deposits demonstrating the presence of *uric* acid. In the management of these Antilithics, many obstacles were at one time thrown in the way, from a fallacious opinion that the caustic or pure Alkalies are likely to injure the stomach, and could not be taken to an extent sufficient to reach the kidney, without being neutralized by the acids in the urinary secretion. Now, although this might be an argument of some weight, were it correct, against the employment of the pure Alkalies as Lithontriptics, yet it is certainly none against their use as Antilithics; for, in those instances in which the lithic acid diathesis prevails, this is more connected with the state of the digestive organs than in those cases in which the phosphates are deposited. The first effect of pure Alkalies upon the stomach is to allay irritation, and to lessen that hasty secretion of the gastric juice which favours acidity. Indeed, in almost all cases, I am disposed to ascribe the advantages derived from Alkalies, in correcting acidity of the stomach, less to their neutralizing the acid already existing in the organ, than to their sedative power, and the taking off of that state of irritability which, by affecting the secretion of a hasty and imperfect gastric juice, favours the production of acid. With regard to the injury arising from large doses of pure Alkalies, these may have arisen from the indiscretion of too rapidly bringing up the dose; but, when this is done with caution, the *pure potassa,* in the solution ordered by the London College, may be given to the extent of even m. cxx, three times a day, with evident advantage to the habit in every respect. I have generally combined it with a vegetable bitter.

The question presents itself—are Alkalies conveyed into the bladder? There is no difficulty in determining our reply in the affirmative: they certainly reach the urinary organs; and they operate in not only checking the prevailing lithic acid diathesis, but in bringing on a calculous deposit, depending on an opposite condition of the habit, when they are given in excess and have been too long continued. This must be carefully avoided; and, as soon as the urine changes paper of litmus which has been reddened, to blue, or infusion of rhubarb, turmeric paper to brown, the use of the Alkalies must be discontinued. Sometimes, however, they may be long used with

the greatest advantage. A very satisfactory case, illustrative of this fact, has been recorded by Dr. Marcet. The patient was a clergyman; he persevered in the use of an alkaline lixivium for ten years, and during that time passed many calculi, all of which had their angles rounded, "and their edges blunted in a manner which could hardly be explained, except from the long-continued influence of the alkaline medicine*.

The *carbonates* are mild forms of exhibiting the Alkalies; and, if the results which are recorded of their beneficial effects be correct, they are, in many instances, preferable to the pure Alkalies. The influence, as a solvent of lithic calculi, of the bicarbonate of potassa, prepared by the hand of Nature in the waters of Vichy, has been demonstrated in several instances; but in none so remarkably as a case published by Dr. Charles Petit, in which the calculus, which had been clearly ascertained to exist in the bladder, and had been attempted to be broken down by lithotrity, disappeared, or, in other words, was dissolved by the internal use of these waters, and the injection of the bladder by means of the double catheter. The artificial bicarbonate of potassa is less frequently used than the carbonate of soda, either in soda water, or in the form of the bicarbonate; but, from whatever cause it may arise, experience has decided that *potassa* has a much more powerful antilithic effect than *soda*, whether uncombined or as a carbonate. One excellent reason for preferring potassa or its carbonate, is the fact ascertained by Dr. Prout, that the lithate of potassa is a soluble salt, whereas the lithate of soda is insoluble. The dose of the bicarbonate of potassa is from gr. x to ʒi, and it may be taken two or three times a day. In this case the bicarbonate is decomposed in the habit, and the Alkali only is carried to the kidney.

With regard to *ammonia* and its carbonate, it is probable that the whole of its effects are due to its influence on the stomach: and indeed it is upon this principle that it appears to act so favourably in those cases of the gouty diathesis in which the deposition of red gravel, as it is termed, from the urine, alternates with fits of gout, or in which the disease appears to affect the joints and the kidneys alternately.

In the lithic acid diathesis, the use of *magnesia* as an antilithic was brought before the notice of the profession in a paper by Mr. Brande, published in the Philosophical Transactions for 1810, and in an essay which is printed in the 6th vol. of the Journal of Science and the Arts. The observations of Mr. Brande have in a great degree been confirmed by subsequent experience; and magnesia is now much employed as an Antilithic. It is very evident that this substance can only exert its influence in the stomach; and, when it is combined with bitter vegetable tonics,

* Loco citato, p. 151.

and precautions are taken to prevent its accumulation in the bowels, by the occasional use of purgatives, individuals liable to the constant formation of red sand have been effectually relieved. But, if Magnesia or even Alkalies be depended upon, without proper attention to improve the tone and general state of the digestive organs, disappointment will follow the employment of the best Antilithics. The dose of magnesia is from gr. x to gr. xxx of the calcined, and from ℈i to ʒi of the carbonate.

When there is reason for thinking that the alternating calculi are forming, then, it is said, that the acids and the Alkalies should be alternately administered. But this recommendation involves too chemical a view of the subject; the alternate depositions of lithic acid and of the phosphates do not so much indicate a state of stomach at one time acescent and at another alkalescent, as it indicates a continued state of indigestion, varying from accidental circumstances, and only requiring to be removed, to prevent the future deposition of either kind of calculous matter*. The only mode of relieving stone already existing in the bladder is by the aid of surgery: but this is not the place to notice improvements in that art.

c. TONICS OPERATING AS ANTILITHICS.

If the opinions which have been delivered respecting the connection between the state of the stomach and the urinary secretion be correct, it will be readily perceived that the importance of obviating any irregular action of the digestive organs should be the first attempt to cure the disposition to the formation of calculus. This part of our subject involves a long and interesting inquiry into the nature of dyspeptic affections, which will be out of place in this work. I will, therefore, confine my remarks to the influence of *Tonics* and *Astringents* as Antilithics.

The *Tonics* generally employed in cases of a disposition to calculi are the vegetable bitters; and when the indigestion depends on simple deficiency of tone in the stomach, preventing the secretion of a due quantity of gastric juice, these are undoubtedly serviceable; but, in a few cases, indeed, as far as my experience has enabled me to form a judgment, does the dyspepsia that produces calculi depend on this cause. If we reflect on the fact, that it is in the gouty diathesis and in similar states of the habit that calculi most frequently occur, in conditions of the stomach arising from over-excitement and excessive indul-

* Besides the Essays of Mr. Brande, already noticed, much information on this subject will be found in the work of Dr. Marcet, on "the Chemical History and Medical Treatment of Calculous Disorders;" in the masterly volume of Dr. Prout, entitled "An Inquiry into the Nature and Treatment of Gravel, Calculus, and other Diseases connected with a deranged Operation of the Urinary Organs;" Dr. Wollaston's papers in the Phil. Trans.; and a paper by Dr. W. Phillips, in the 6th vol. of the Medical Transactions.

gence and indolence, we have no difficulty in satisfying our minds that the irregular secretions of the stomach in such cases depend, as I have already stated, rather on a subacute inflammation of the viscus than on simple debility. This is the condition of the organ, in particular, in which there exists a superabundant acid, and in which deposits of lithic acid in the urine are noted. In these instances, therefore, any expectations of benefit from bitters will undoubtedly be disappointed. It is in the opposite state of the stomach, such as occurs from the course of years, when the debility is direct, and the deposits are of an ammoniacal nature, that bitters are most serviceable; and the choice of the substances is of little moment, provided they are of a kind to pass partly into the circulation, and to give a moderate degree of stimulus to the kidneys. For this reason, those bitter vegetables which at the same time contain an astringent principle are more serviceable than simple bitters. This indirect influence of astringents on the urinary organs has been well known from a very early period, although their efficacy was erroneously ascribed to their exercising an expulsory power—an opinion that prevailed until it was corrected by Dr. Cullen, who first pointed out the influence of tonics and astringents in relieving the symptoms of calculus, independent of any chemical or solvent properties which they were formerly conceived to possess. The only tonics which demand particular attention, as suited for antilithic purposes, are the leaves of Barosma, or Buchu, *crenulata*, or *serratifolia*, and the Pareira Brava.

1. Buchu Leaves. *Diosma*. L. *Bucku*. E. *Diosmæ crenulatæ folia*. D.—Buchu has been already described (p. 988).

The medicinal properties of its leaves are such as render them admirably adapted for calculous complaints; as, at the same time that they afford tone to the digestive organs, they are sudorific or diuretic, according to the condition in which the surface is maintained. Thus, if the deposit be lithic acid, owing to the state of the surface, the Buchu leaves, by their sudorific influence, counteract this state, whilst, at the same moment, they are giving tone to the constitution, and thereby promoting in both ways that condition of the habit which is least favourable for the formation of red gravel*. Indeed, Dr. Carter assures us that they check the formation of the lithic acid†. Buchu may be administered in the form of powder, in doses of ℈i to ℥ss. Both an infusion and a tincture of these leaves is ordered, either of which may be advantageously administered in all cases of the calculous diathesis in which tonics are indicated.

* A spirit distilled from the leaves of the Diosma in the leys of wine, is regarded by the natives of the Cape of Good Hope as a sovereign remedy in chronic affections of the bladder.

† Lond. Med. Repos. 1826, p. 348.

INFUSION OF BUCHU. *Infusum Diosmæ.* L. *Infusum Bucku.* E. D.—Take ℥i (℥ss, D.) of Buchu; boiling distilled water, Oi (f℥viii, D.); macerate for four (two, E.) hours in a lightly covered vessel, and strain (through linen or calico, D. E.). The dose is from f℥i to f℥iss. I have found it an excellent vehicle for the administration of the alkalies.

TINCTURE OF BUCHU, *Tinctura Bucku,* E. D., is made by macerating for seven days ℥v of Buchu in Oii of Proof Spirit, then pouring off the clear liquor and filtering. It may be made, also, by percolation, as ordered by the Edinburgh College. The dose is f℥i to f℥ii. The preparations of Buchu have long been favourite remedies with the Dutch in diseases of the urethra, prostate gland, and bladder of urine.

2. PAREIRA BRAVA. *Pareira.* L. E.—This is the root of *Cissampelos Pareira**, a native of South America and the West Indies, belonging to the natural order Menispermaceæ. In the West Indies it is familiarly known by the Portuguese name, *Parreya-brave,* or Wild Vine. It is a climbing shrub, with a woody, branching root; with smooth or close pressed down stems, and nearly orbicular, peltate leaves, smooth above and covered below with a silky pubescence. It is a diæcious plant. The root, which is the part employed, is long, thick, woody, and covered with a furrowed brown bark, transversely wrinkled. Internally the colour is yellowish grey, and it displays concentric circles, more or less numerous according to the age of the root. According to the analysis of M. Feneuille, it contains a *soft resin,* a *yellow bitter matter,* a *brown colouring principle, fecula,* an *azotized matter, acidulous malate of lime, nitrate of potassa,* and *some mineral salts*†. This root was known to the Brazilians as an excellent remedy in all obstructions of the urinary organs long before its introduction into Europe. The root is nearly inodorous: its taste is sweetish, with some degree of bitterness and slight acerbity. It yields these properties to both water and alcohol; but its best menstruum is proof spirit. Wiggers affirms that its active principle is an uncrystallizable alkaloid, named Cissampelina: which is insoluble in water, but soluble in alcohol, ether, and acids; and has an intense, sweetish, bitter taste. Helvetius was among the first of the European physicians who investigated its influence in nephritic and calculous cases: he ascribed its efficacy to some lithontriptic powers; and Geoffroy to its solution of the mucus to which the sabulous matter adheres in calculous diseases: but it is more probable that its effects are due to its tonic influence on the bladder. Sir B. Brodie extols its powers in chronic inflammation of the bladder: it diminishes the

* Woodville's Med. Bot. third edit. p. 168, pl. 65. Richard, Hist. Nat. Med. t. ii, p. 614. Lindley, 372.

† Journ. de Phar. vii, p. 404.

irritability of the organ, and lessens the secretion of the ropy, alkaline mucus. There are only two officinal preparations of Pareira, an Infusion and an Extract; but I prefer the decoction, which is prepared by simmering four ounces of the root in three pints of water, until the fluid is reduced to two pints, and then straining. From six to twelve fluid ounces of this decoction may be taken in twenty-four hours. Sir B. Brodie adds to it the tincture of Henbane; and, where there is any deposit of the triple phosphates, indicated by milky urine, with an irridescent pellicle on the surface, he adds hydrochloric or nitric acid.

INFUSION OF PAREIRA. *Infusum Pareira.* L. E.—Take ʒvi of Pareira, and Oi of boiling water. Infuse for two hours in a lightly covered vessel, and strain. The dose is f℥i to f℥iii.

EXTRACT OF PAREIRA. *Extractum Pareiræ.* L. E.—Prepared from the decoction, concentrated to a proper consistence. Dose, gr. x to ℈i.

d. LOCAL LITHONTRIPTICS.

These consist of alkalies and acids, properly diluted, injected into the bladder; but it has been ascertained that the bladder cannot bear the degree of strength of an alkaline injection sufficient to dissolve a lithic calculus. Some experiments of Sir B. Brodie, however, have demonstrated that loose concretions of the phosphates and of carbonate of lime can be acted upon by a weak solution of nitric acid, and thus gradually removed from the bladder. The strength of the solution used by Sir B. Brodie was two minims and a half to each fluid ounce of distilled water. No suffering attended the injection, which was effected through a double cannula of pure gold; but the patients experienced relief from all their symptoms, the adhesive mucus from the coats of the bladder being lessened, and the frequent desire to empty the bladder much abated. In his experiments, by testing the fluid which had been employed with a concentrated solution of ammonia, the phosphates were abundantly precipitated, proving that the calculi in the bladder had been acted upon.

I have only, again, to remark that it is on *Antilithics* only, as preventives of calculi, that we can place any reliance; and these we find in acids and alkalies, as circumstances may demand; but not less in whatever promotes the healthy functions of the digestive organs and those of the skin—that temperance, exercise within due limits, a regular and somewhat open state of the bowels, and restoring the tone of the system when it fails, constitute the best aids to the influence of Antilithics.

SECTION V.

DISINFECTANTS.—MEDICAMENTA ANTIPESTIFERA.

Syn.—*Antiseptics.*

Before examining the substances which act as disinfectants, it may be proper to acquire some correct ideas of the nature of infection and contagion. Both produce diseases in those who are in contact with or near the sick, without the influence of the imagination. It is unnecessary to enquire into the causes that influence the production of the same symptoms when a contagious disease is communicated, whatever may be the state of the system of the person receiving the contagion. The matter, whether it be introduced into the blood, as in inoculation of syphilis, small-pox, or cow-pox, or be conveyed through the medium of the air, as in the case of infection, is the true fomes of the disease, and can communicate a disease only of the exact nature of that which generated it. But this virus, whatever may be its nature, can be received in certain states of the living system only; and it is probable that the causes which are suspected of originating a contagious fever, or disease of any kind, are often those which bring the body into that condition which is best fitted to receive the impression of the exciting causes of the disease, however these may be produced. Thus, in a crowded, ill-ventilated apartment, such as the black hole of Calcutta, or the crowded berths of transport vessels, or ill-ventilated jails, the effluvia arising from the bodies of many individuals becoming, as it were, stagnant, are capable of so lowering the vitality of the habit as either to produce disease itself, or to render the body more susceptible of diseased impressions. Whichever of these opinions is correct is of little importance for our purpose: it is sufficient to know that diseases often arise from certain impregnations of the atmosphere. These are of several distinct kinds:—1. The proportion of carbonic acid in a limited portion of air may greatly exceed that which can be borne by the living system with impunity.

2. Hydrogen and its compound gases may superabound, constituting malaria or miasmata.

3. There may be a large proportion of gaseous matters, the products of putrefying animal substances, and of an *ammoniacal* or *alkaline nature.*

4. The air may be tainted with matter emanating from the bodies of persons labouring under contagious diseases.

All of these effluvia, when largely diluted with atmospheric air, exert little influence on the body; but, in a concentrated state, they produce the most deleterious effects. They are supposed to operate either by an immediate impression on the nerves,

or by being taken into the system through the lungs or through the stomach, into the latter of which they are supposed to be carried by the saliva. It is difficult to decide which of these opinions is correct. I believe that an impression on the nerves is all that is required; and this may be made upon the surface generally, or upon the mucous membrane of the lungs: in either case, there exists a sufficiently widely extended sensitive membrane, on which the infectious atoms may operate.

It has always been supposed that the matter of infection can be destroyed by decomposition; and, for this purpose, means the most opposite have been, at different times, adopted, such as large fires, concussions given to the air by firing gunpowder, and the sprinkling of water. For a long time also it was supposed that all substances which aid in retarding the progress of the putrefactive process, in dead animal matter, would also destroy the matter of infection; hence, *camphor, resins, bitumens, benzoin*, and *aromatics*, were employed, as well as *vinegar*, one of the most common disinfecting agents of former times*, in the apartments of the sick and in hospitals; and, indeed, it was not until the close of the eighteenth century that the inadequacy of these means was acknowledged. It is unnecessary to notice the numerous schemes for disinfecting which have been proposed: three only deserve attention—the employment of *hydrochloric acid, nitric acid*, and of *chlorine gas*.

a. ACIDS.

1. HYDROCHLORIC ACID.—Morveau conceived that the nature of infection could be determined by chemical tests; but, in forming this opinion, he was mistaken. He ascertained, however, that some gaseous agents can destroy certain noxious effluvia; and he imagined that the power of gases to effect this was in the ratio of their facility in parting with their oxygen: but, after many experiments with a variety of substances, he at length discovered that Hydrochloric Acid, in the gaseous state, was the best adapted of those substances which he had tried for effecting this purpose.

In 1773, Morveau was employed to disinfect the Cathedral of Dijon, which had been rendered unfit for religious service by the putrid emanations from the vaults beneath it. He effected its purification by diffusing through it the vapour extricated from six pounds of common salt, on which were poured two pounds of concentrated sulphuric acid. In this case, Muriatic Acid was evolved, which so completely neutralized or destroyed the noxious

* We are told that Cardinal Wolsey, when he landed from his barge, and had to pass through a troop of mendicants, had the rind of an orange stuffed with a sponge steeped in vinegar, to prevent infection.

effluvia, that worship was performed in the church four days afterwards. In the same manner he disinfected the prison of the same city, into which the infection of a most malignant fever had been carried from other jails. The success of Morveau brought this acid into general use; and its powers must still be acknowledged, although more powerful means have been, since that time, employed.

Some inconvenience arises from using the proportions of salt and acid employed by Morveau; instead of which, the proportions now adopted are *twelve parts* of acid to *fifteen* of chloride of sodium, which should be moistened before the acid is poured on it. No heat is required: the ingredients may be mixed in flat earthen dishes, and left to exhale the gaseous acid, formed by the decomposition of the muriate.

2. Nitric Acid.—In 1780, Dr. Carmichael Smythe* suggested the employment of nitric acid fumigations; and received a Parliamentary grant of £5,000 for his invention. His experiments were made in the depôt of Spanish prisoners at Winchester, during the progress of a fever, of a most destructive character, which carried off a large proportion of those unfortunate men. The *Nitric Acid Fumes* were extricated by mixing together equal parts of nitre and of strong sulphuric acid, in a saucer, and placing it on hot sand. It is not easy to account for the efficacy of this acid, unless we suppose that it combines with the ammonia, in the same manner as the hydrochloric acid fumes, and forms nitrate of ammonia, which precipitates the acrid fœtid oil, supposed to constitute the infectious agent. But I am disposed to think that the influence of this gas is exerted rather on the body of the patient who is exhaling the infectious effluvia, than on the atmosphere. The influence of Nitric Acid, when largely diluted and taken into the stomach, is that of a powerful tonic; and this is well demonstrated in very low states of the habit, such as occur in purpura, in which the blood is poured out from the capillary vessels, producing spots on the skin, and a general solution of continuity, approaching almost to a state of putrefaction: nothing, in such a condition of the system, so rapidly brings up the tone of the habit, and, as it were, rouses the vital energies, as Nitric Acid. Now, in crowded ships and hospitals, where infectious fevers exist, the atmosphere, it is true, is loaded with the fomes of contagion and with noxious effluvia; but, if the powers of life can be sustained, the body withsthands its baneful influence; and, at the same time, a smaller quantity of fresh effluvia must necessarily be thrown off by the patients, if they are in a state of less debility, than before. In this manner, I am of opinion,

* The Nitric Acid was first used by Dr. Johnston of Kidderminster; but the most decisive proofs of its efficacy were displayed on a large scale in the depôt of Spanish prisoners at Winchester, and in the Russian fleet, by Dr. Carmichael Smythe.

Nitric Acid fumes operate in hospitals and prison ships; whilst they act in purifying the atmosphere only to a certain extent, by destroying the ammonia which is the vehicle of the fœtid effluvia, whatever these may be. Be this as it may, Nitric Acid is less useful than hydrochloric acid, and especially in purifying infected houses and clothes; but it has one advantage over hydrochloric acid—it is less inconvenient to the individuals who are in the apartments during their fumigation; and therefore may be used in situations whence the sick cannot be removed.

In using the ingredients for extricating the Nitric Acid, it should be recollected that half an ounce of each is sufficient for disinfecting an apartment containing a thousand cubic feet of air. In large apartments, it is better to multiply the vessels containing the ingredients than to use them in a large quantity in one vessel.

b. CHLORINE.

CHLORINE GAS, for the purpose of disinfecting, is extricated from a mixture consisting of equal parts of dry sea-salt, chloride of sodium, and of binoxide of manganese, acted upon by two parts of sulphuric acid mixed with one part of water. The salt should be intimately mingled with the binoxide of manganese in powder, and the diluted acid be allowed to cool before it is used. The ingredients may be put in common earthenware pans.

Chlorine was first suggested as a disinfecting agent by Hallé, in 1785: it was afterwards adopted by Morveau, in preference to hydrochloric acid; and it has been since very generally employed. As I have already stated, Morveau imagined that miasmata depended, in a great degree, on the extrication of ammonia, combined with, or holding in solution, an acrid, fœtid oil. Whether this opinion be critically correct, it is true that ammonia is largely formed in putrefying animal matter, probably by the union of nitrogen and hydrogen, both of which are abundantly given out during the process of putrefaction. The same effluvia are emanated in very crowded apartments and, wherever circumstances occur to lower the powers of vitality. As far as the ammonia is concerned, we can readily conceive how the hydrochloric acid gas operates; as the substance formed by the union of the ammonia and the acid gas, namely, hydrochlorate of ammonia, is incapable of holding the fœtid, acrid oil in solution: hence, it is precipitated and rendered inert. But hydrochloric acid vapour has little effect on some of the other deleterious gases—such, for example, as carburetted and sulphuretted hydrogen; it is therefore now seldom used, Chlorine being extricated with equal facility; and, besides answering the same purpose as the acid gas, it decomposes readily both the above-mentioned gases. The Chlorine also decomposes the ammonia, and forms hydrochloric

acid by combining with its hydrogen. The other gases generated in the process of putrefaction, detrimental to life, are sulphuretted hydrogen, phosphuretted hydrogen, and carburetted hydrogen. Chlorine combines with the hydrogen of all these; and, by decomposing them, destroys their sedative influence on the living system, and thereby renders them innocuous.

In considering the process adopted by Dr. Faraday for disinfecting the Penitentiary at Millbank, it would appear that half a pound of dry chloride of sodium, the same quantity of peroxide of manganese, and one pound of sulphuric acid, would be sufficient for fumigating a building containing 288,714 cubic feet of air*. In applying this gas, some inconvenience arises from its irritant influence on the lungs, and therefore it has been thought to be inapplicable for inhabited apartments: but there is more speciousness than truth in this opinion; and daily experience of its use in the apartments of phthisical patients has completely disproved it. In the belief of this supposition, however, Morveau invented his disinfecting bottle, in which the chlorine is slowly disengaged, and the quantity admitted to escape is under the regulation of the attendants in sick apartments. It consists of a strong glass jar, to which a flat ground-glass lid is accurately fitted. The jar is enclosed in wood, and the lid acted upon by a screw, so as to be kept firmly closed, or to be opened at pleasure. The jar is charged with a mixture of four parts of binoxide of manganese finely powdered and sifted, ten parts of nitric acid of sp. gr. 1·40, and ten parts of hydrochloric acid of sp. gr. 1·134: the chlorine is slowly extricated from this mixture; and, being confined in the upper part of the jar by the power of the screw, it acquires an increase of elasticity, and readily issues forth on the smallest relaxation of the pressure on the lid of the jar. A moderate sized jar of this kind, properly arranged, retains its disinfecting power for many months.

Chlorine may also be employed as a disinfecting agent, as it is spontaneously extricated from solutions of the chloride of lime or the chloride of soda. The former of these solutions is the ordinary bleaching powder. This chlorine of soda in solution has a pale yellow colour, a slight odour of chlorine, and a sharp saline taste, which leaves an acrid sensation on the tongue. In this solution, and in the mixture of the chloride of lime with water, the chlorine is retained by a feeble affinity: so that, when exposed to the air, it is evolved, and the lime and the soda are converted into carbonates; a process which proceeds more rapidly when the air is loaded with putrid effluvia, owing to the great quantity of carbonic acid produced during the putrefactive process. That the evolution of the chlorine depends on the decomposition of the chloride by the attraction of carbonic acid

* Journ. of Sciences and the Arts, vol. xviii.

from the air, is easily demonstrated by passing a stream of carbonic acid through the solution of the chloride of lime: the chlorine is extricated, and the lime precipitated in the form of a carbonate.

The Chloride of Lime was first used as a Disinfectant in 1809, by M. Masuyer of Strasburg; but little attention was attracted by the experiments of that chemist, and the chloride remained neglected, for this purpose, until 1822, when M. Labarraque introduced it to the notice of the profession. The dry Chloride of lime may be used with equal advantage as the solution, by exposing it in shallow pans in the places to be disinfected. Under every form, it is the Chlorine which is the active agent; and, although some individuals complain greatly of the odour of this gas, yet this is a trivial inconvenience when compared with the pernicious property of the effluvia which it is so admirably calculated to remove.

Employed in limited spaces, as in rooms of houses or the wards of hospitals, both the nitric and hydrochloric acid gases and Chlorine possess an undoubted power of destroying the infectious matter of typhus and other fevers: they correct also fœtid odours, and check the putrefactive process. Their employment, nevertheless, should not supersede the necessity of white-washing walls, washing clothes, ventilation, and other means; all of which, although they do not neutralize the virus as the gases are supposed to do, yet aid greatly in weakening its force on the system.

c. CALORIC.

Although the influence of large fires, in checking the spreading of infectious diseases, had been occasionally experienced, yet the scientific examination of the influence of Caloric was not entered upon until Dr. Henry, of Manchester, made his experiments. By these he proved that substances, impregnated with the fomites of different contagious diseases, exposed to elevated temperatures, namely, from 200° to 204°, for a considerable length of time, were rendered incapable of communicating the diseases, even when the clothes had been worn during the whole period of the infectious fevers. He enclosed the substances to be disinfected in air-tight canisters, and exposed them to dry heat for the specified time; and he regards this process as superior to the influence of gases, inasmuch as these may be arrested by compressed materials, while no opposition can prevent the transmission of Caloric. The agent which he employs for conveying the Caloric is steam; and this is passed between the walls of a tinned copper box and an outer case of the same material. The most delicate goods cannot be injured by the application of the degree of heat extricated by this means.

Although the use of acid fumigations—at least, those of sulphurous acids produced by burning sulphur, and the vapour of acetic acid—have been known since the days of Hippocrates, and many favourable effects have resulted from their employment and from that of chlorine, yet it is proper, before dismissing the subject, to notice some of the disappointments and disadvantages that have occasionally followed their employment. Thus, at Torgau, Dr. Graefe, Surgeon-general to the Prussian army, tried both the hydrochloric and nitric acid vapours, and also chlorine, in wards of the military hospital containing forty beds each. The fumigations were repeated with closed windows, every two hours, for six weeks. In one ward, two of the attendants were infected, and six patients died; in each of the other two wards, three attendants were infected, and seven patients died; and a young man, whose sole business it was to diffuse the nitric acid vapour, was infected, and fell a victim to the fever.

When the lungs are inflamed during fever, these gases cannot be employed; for, although chlorine, in a highly diluted state, has been found beneficial when inhaled in the latter stages of phthisis, yet, in the commencement of the disease, when active inflammation exists, it proves injurious by the irritation which it excites; and the same is the case in all pulmonary affections of an inflammatory character*.

* Much information on this important subject may be obtained from "The Reports of a Society for bettering the Condition of the Poor," vol. i, iii;—Lind on Fever and Infection;—Haygarth's Letter to Dr. Percival;—and Labarraque "De l'Emploi des Chlorures de Chaux et de Sodium."

PART V.

MECHANICAL AGENTS.

It is difficult to offer a correct definition of this division of the Materia Medica; because, although the substances comprehended in it are said to exert no influence on the vital principle, yet we can form no idea of any substance which can be applied to the living body without exciting some sensation in it; consequently, no substance can be strictly termed mechanical which in any degree can influence the vital principle. If a quantity of gum or fecula be swallowed, no local effect is perceived in the stomach; the gum is in part digested imperceptibly; in part it is taken into the circulation, and, lessening the acrimony of the secretions, produces a salutary effect on the system. Still, this substance is not a vital agent.

The term mechanical is intended to express that the articles contained in this division do not produce their effects as remedial agents by any direct influence which they exert on the vital principle. The division contains two classes of medicines only, *Demulcents* and *Diluents*.

SECTION I.

DEMULCENTS.—MEDICAMENTA DEMULCENTIA.

Syn.—*Emollients, Relaxants.*

The usual definition of a Demulcent is the following—"a substance which diminishes the vital tension of tissues, and lessens acrimony, by lubricating, softening, and rendering more flexible the solid part of the body." There is no difficulty in comprehending how these effects are produced in bodies devoid of vitality: thus, caloric, within a certain limit, combined with water; or oil, applied by friction; enters the interstices of the solid, diminishing the force of cohesion: the entire density of the part is lessened, and the whole becomes more flexible. But, when we reflect that one of the effects of vitality is the preservation of the continuity of the body, in opposition to the efforts of

those extraneous matters which constantly tend to its solution, we pause before admitting the same explanation of the influence of Demulcents on the living body. It is, nevertheless, true that *warm water*, of a temperature not exceeding 98° Faht., and friction with oily and bland fatty substances, render parts flexible which are morbidly rigid, and enable them to be more easily moved by the influence of the will. How is this to be explained? Does it admit of no explanation, if we refuse to adopt that which has reference to dead or inert matter? or are we to attribute it to the relaxing influence of the substances upon the extreme vessels of the surface, and the propagation of this by *sympathy* to the rest of the body? In reference to the living body, there can be no hesitation in adopting the latter opinion; for, not only is this effect produced by warmth and moisture, but, it is a fact well established by the use of oily friction in the commencement of the plague, that oil, by relaxing the skin, promotes the excretion, of perspiration, in the same manner as the application of warmth and moisture. It is true that the first effect, in both instances, is purely mechanical; for the cuticle possesses little or no vitality, and is composed of scales which are separated from one another, either by the application of warmth and moisture, or by friction with oily matter; but the subsequent effect must result from the matter, thus admitted to the true skin, being applied to the sentient extremities of the cutaneous nerves, and, by diminishing their sensibility, decreasing the contractile force of the muscles; and, as I have already stated, propagating this state of relaxation by sympathy to the rest of the body. When the rigidity has been of long standing, and the organization of the part is in some degree changed, then Demulcents, if they act at all, produce their effects in the same manner as upon inert bodies.

But substances also, which are taken into the stomach, produce a demulcent effect, and apparently act upon distant organs. A question arises, suggested by the nature of the substances—what effects has digestion upon them? Undoubtedly a large portion of almost every Demulcent taken into the stomach is digested; but a part of some of them, at least, escapes this process, and is carried into the system. In whatever manner they operate, they are to be regarded merely as auxiliaries, calculated to do no more than palliate certain symptoms, or to afford nutriment to the body. Almost all of them are inodorous and have a mawkish taste. Their long-continued use by persons of delicate habits, in whom the digestive organ in particular is in a weakened or atonic state, increases the paleness, flabbiness, and languor of such persons; but, in those of vigorous habits, or in ordinary health, they produce no visible effect: we must, therefore, judge of their internal power by their external effects.

Demulcents may be divided into two sections; the *first* comprehending those which are supposed to act medicinally, the *second*

those which are used dietetically. Substances which produce demulcent effects upon the body are all obtained from the animal and the vegetable kingdoms of nature. The Animal Demulcents may be arranged under three general heads—*gelatin, cetine,* and *wax:* the Vegetable under six—*gum, mucus, tragacanthin, glycirrhizin, fixed oil,* and *fecula.* The remarks upon each of them may be brief.

TABLE OF DEMULCENTS.

A. DEMULCENTS MEDICINALLY EMPLOYED.

* *Animal.*

a.—Gelatin—procured from			
Horns—Cervus *Elephas.*	1.	7.	Ruminantia.
Sounds—Acipenser *Sturio.*	4.	2.	Sturiones.
b.—Cetine—from			
Physeter *Macrocephalus.*	1.	8.	Cetacea.
c.—Wax—produced by			
Apis *Mellifica.*	4.	12.	Hemenoptera.
d.—Fixed Oil—			
Suet—Ovis *aries.*	1.	7.	Ruminantia.
Lard—Sus *scrofa.*	1.	6.	Pachydermata.

* * *Vegetable.*

e.—Gum—exuded by			
Acacia *Vera.*	23.	1.	Leguminosæ.
* ——— *Seyal.*	—	—	———
* ——— *Tortilis.*	—	—	———
* ——— *Ehrenbergii.*	—	—	———
* ——— *Senegalensis.*	—	—	———
f.—Mucus—procured from			
Roots—Althæa *officinalis.*	16.	8.	Malvaceæ.
Malva *sylvestris.*	—	—	———
Seeds—Linum *ussitatissimum.*	5.	5.	Linaceæ.
Pyrus *Cydonia.*	11.	5.	Rosaceæ.
g.—Tragacanthin—exuded by			
Astragalus *verus.*	17.	4.	Leguminosæ.
* ——— *Gummifer.*	—	—	———
* ——— *Creticus.*	—	—	———
Prunus *cerasus.*	12.	1.	Myrtaceæ.
h.—Glycyrrhizin—in			
Roots—Glycyrrhiza *glabra.*	17.	4.	Leguminosæ.

i.—BLAND FIXED OIL—in

Fruits—Amygdalus *communis.*	12.	1.	Amygdaleæ.
Oleæ *Europeæ.*	2.	1.	Oleaceæ.
Coccus *Buteracea.*	1.	1.	Palmæ.

B. DEMULCENT SUBSTANCES DIETETICALLY EMPLOYED.

a.—FECULA—from

Roots—Maranta *Arundinacea.*	1.	1.	Marantaceæ.
Plant—Cetraria *Islandica.*	24.	3.	Lichenes.
Bulbs—Orchis *Mascula.*	20.	2.	Orchideæ.
Pith — Sagus *farinifera.*	1.	1.	Palmæ.
Cycas *circinalis.*	1.	1.	———
Seeds—Triticum *hybernum.*	3.	1.	Gramineæ.
Avena *sativa.*	—	—	———
Hordeum *distichon.*	—	—	———

A. MEDICINAL DEMULCENTS.

* *Animal Productions.*

a. GELATIN.

Gelatin is found in the skin, membranes, tendons, cartilages, and bones of land animals, and the sound or swimming-bladder of fishes; but not in any healthy animal fluid*. It is a semi-transparent, brittle substance: it dissolves in cold water; but more readily in hot water; and, on cooling, assumes a semi-diaphanous, tremulous appearance. If in this state it be agitated with cold water, a complete solution takes place.

Gelatin, when freed from water by evaporation, so as to become brittle, is not susceptible of change, and may be kept for any length of time. For medicinal use, it should, therefore, always be kept in the dry state. But, when it is united with so much water as to render it tremulous, it soon undergoes decomposition, first becoming acid, then exhaling a fœtid odour; and putrefaction takes place. Exposure to the air is not necessary to effect this change in Gelatin. When exposed to a high temperature, Gelatin first whitens, then shrivels, and is carbonized: tremulous Gelatin first melts before it undergoes these changes. When tincture of galls or any astringent vegetable solution is dropped into a solution of Gelatin, an insoluble precipitate takes place; this is tanno-gelatin, a compound of the Gelatin and tannic acid: and it is this combination that produces leather. Gelatin, like gum, renders oils miscible with water, forming emulsions.

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* Berzelius—Bostock.

Alcohol and ether do not dissolve Gelatin, but they separate it from the water of its solution: in a thin solution, however, neither alcohol nor ether produces any obvious change. All the concentrated acids decompose Gelatin; but diluted acids dissolve it unchanged. When chlorine gas is mixed with a solution of Gelatin, a white solid matter, in filaments, is separated, which Bouillon la Grange has named *oxygenized Gelatin;* but the nature of this change is unknown. The alkalies, assisted by heat, dissolve Gelatin, but do not produce soaps. None of the earthy salts, with the exception of those of baryta, precipitate its solution; phosphate of soda, however, causes a slight milkiness in it. Among the metallic salts, nitrate of silver only precipitates the solution of pure Gelatine.

According to the analysis of Gay-Lussac and Thenard, the components of Gelatin are — carbon 47·881, + oxygen 27·207, + hydrogen 7·914, + nitrogen 16·998, = 100·000. Such are the chemical characters of Gelatin; but these differ in some particulars, according to the nature of the substances which yield it.

HARTSHORN SHAVINGS. *Cornu.* L. E. *Cornu Cervini ramenta.* D.—The horns as well as the hoofs of the greater number of animals consist of albumen; but those of the stag closely resemble bone, and yield a considerable quantity of gelatin.

The Stag, Cervus *Elaphus*, is a native of the whole northern parts of our hemisphere. The male acquires horns at two years old; they are shed annually, about the end of February and in March; and are reproduced in July and during the summer, in a soft, tender state, full of blood-vessels, and covered with a downy cuticle, under which cartilage forms; and as the bony matter is deposited, the downy disappears by degrees, until they become hard, compact, and bony. It is supposed that the number of the points of the horns indicates the age of the animal; but, after the eighth year, this is very uncertain*.

Pure Hartshorn Shavings, which are formed by planing down the internal white part of the horn, yield to water, by decoction, 27 parts of gelatin, + 57·5 of phosphate of lime, + 1·0 of carbonate of lime, + 14·5 of water, = 100·0 of the horn: the gelatin is inodorous and insipid, and has all the chemical properties of pure gelatin. As sold for medicinal use, these shavings are mixed with bone shavings, which may be distinguished by their greater degree of brittleness: but the adulteration is of too little consequence to merit attention. The retention of Hartshorn in the list of the Materia Medica is the relic of a period of inert

* A curious fact attending the growth of the Stag's horns is worthy of notice, in a physiological point of view. When the animal is castrated, if this is performed at a very early age, the horns do not grow; if at a later period of life, the horns do not alter nor fall off during the life of the animal. I have a pair of horns in my museum, presented by my friend, Sir F. Shukburgh, Bart., which were produced on a castrated deer on his own estate.

practice: it yields a light and sufficiently nutritious article of diet for the sick and the convalescent; but this very quality renders it useless as a medicine.

Isinglass. *Ichthyocolla.*—This substance is not officinal; but it is still much used. The sounds of the Perch, some species of the Cod, and a few other fishes found in the waters of this island and upon its coast, afford isinglass. The Sturgeons, Acipenser *Sturio*, A. *Ruthenus*, A. *Güldenstadtii*, A. *stellatus*, and A. *huso* (p. 70), from which the best is prepared, are caught in the rivers of Russia, in the Nile, and in the Caspian Sea, and occasionally in those of this country.

The Isinglass is the prepared sound or swimming-bladder. It is taken from the fish, slit open, well washed, and freed from the thin membrane which covers it; then beaten, exposed to stiffen a little in the air, rolled, and fixed in a peculiar shape by means of wooden pegs, or folded into leaves like a book, or simply dried without any care. The best Isinglass is generally that which is rolled up and called *staple;* the next best kind is the *book Isinglass:* there are inferior kinds, which are chiefly used to adulterate the better kinds*.

Good Isinglass should be dry, whitish, semi-pellucid, and inodorous. One hundred grains of it should afford ninety-eight of matter soluble in water, which is *gelatin* and *albumen*, and scarcely two parts of solid, insoluble matter, which consist chiefly of *phosphate of soda* and *phosphate of lime.* It also contains Osmazome†. The same objections apply to Isinglass as to gelatin, as a therapeutical agent; and we can only wonder that, while this gelatin is expunged from the last edition of the London Pharmacopœia, that of the hartshorn is suffered to remain. It was formerly regarded as an antacrid, lubricating, and incrassating remedy; but the experience of modern medicine has demonstrated it to be worthless as a remedy. It is useful for forming sticking plaster; and it is also used for making gelatin capsules for copaiva.

As a nutrient, a solution of Isinglass, acidulated with lemon juice, and, when it is admissible, flavoured with wine, is a very proper and agreeable food for the convalescent; but it is much less nutritive than the muscular parts of animals, and also less easily digested. In animal broths, gelatin is combined with oil; and if we can regard it at all in the light of a remedy, it is in this form; in which it is ordered as an enema in the tenesmus of dysentery, and in ulcerations or abrasions of the lower portion of the intestinal canal.

* Isinglass is also imported from the Brazils, the United States of America, Hudson's Bay, and the East Indies.

† Analysis of Mr. E. Solly.—See Royle on the Production of Isinglass, 1842, page 40.

b. CETINE is a name given by Chevreul to the white crystalline scales deposited from alcohol boiled on Spermaceti.

SPERMACETI, *Cetaceum*, L. E. D.—is an inflammable substance, occurring in white, pearly, crystalline plates, brittle, soft, and unctuous: at 112° Faht. it softens and melts; but crystallizes again when cooled. It is insoluble in water, but soluble in 13 parts of boiling alcohol, from which, as the solution cools, it is deposited in brilliant talc-like scales, which are Cetine, a compound of $C.^{16}$ $H.^{16}$ eq. 113·92, or 81.64 of carbon, + 13·86 of hydrogen, in 100 parts. It is also soluble in ether and fixed and volatile oils; but it separates from the latter as it cools. When distilled repeatedly, it is partially decomposed, and becomes liquid, like oil; and, by a farther repetition of this process, a brown acid liquid is produced. It forms a soap with the pure alkalies: the acids have scarcely any action upon it. In the head of the Phyceter *Macrocephalus* (p. 70), or white whale, the Spermaceti is contained in two principal cavities, and some small ones, which are covered with several teguments: namely, the skin; a layer of fat; and a black membrane containing large nerves. The larger cavities are subdivided into smaller chambers, each of which is again subdivided by vertical membranes resembling the lining pellicle of an egg. The lowest cavity contains the purest Spermaceti, which is always fluid during the life of the animal. The Spermaceti is also distributed all over the animal by a peculiar system of tubes, the main trunk of which is improperly termed the *spermatic* vein. Besides being thus found in the *white Whale*, it also exists in all the other Cetaceæ; from the oil of which it is deposited in considerable quantity: and this is also the case, in a more moderate degree, in the oil of all fishes, whether breathing by lungs and mammiferous, or breathing by gills.

The quantity of crude Spermaceti which is dug out of the head of an ordinary-sized whale is seldom less than twelve large barrels full. The oil is separated from it by dripping; and, when sent to England, it has a yellow, unctuous appearance, and a nauseous odour; and is unfit for medicinal use until it is purified, which is effected by first fusing and skimming it, then boiling in a weak ley of Potassa, and afterwards re-fusing and crystallizing it.

Spermaceti, although more employed as a Demulcent, is scarcely more valuable as a remedy then gelatin. It is readily digested in the stomach, in the same manner as animal fat, and is converted into chyle with equal facility as any other animal matter. From some fancied healing virtues, which it was supposed to possess, it was formerly regarded as highly beneficial in all affections of the chest, the kidneys, and the uterus; and, even in the present day, it is often prescribed as a vehicle for preparations of opium, and sedatives after child-bearing. It is not

for us to perpetuate error; and, as an internal remedy, experience has decided against the claims of this substance. Its chief use is in the formation of ointments.

c. WAX is both an animal and a vegetable production. It was long supposed to be merely collected by the Bee from the pollen of flowers, and then wrought up by the insect into the regular and beautiful hexagonal cells which characterize the honeycomb; but this is a mistake: pollen does not yield wax, and it has been ascertained that bee's wax is an animal secretion, the production of the glands termed wax-pockets, which are seated under the wings on each side of the Bee. From the observations of Huber, it appears that Bees (Apis *mellifica*), supplied with sugar only, and shut up in the hive, manufacture Wax, in the same manner as those Bees which enjoy their freedom, and range from flower to flower. The flower yields the honey which the insect eats; and from the sugar of this, after it undergoes animalization in the stomach of the bee, Wax is produced. But Wax, as above stated, is also a vegetable production, and is found as an abundant excretion of many plants. What is called the bloom, on some leaves and fruits, is Wax: the seeds of the Myrica *cerifera*, an American tree, is so thickly encrusted with Wax that it is separated from them for the purposes of commerce; and the trunk of a South American palm, the Ceroxylon *Andicola*, is thickly covered with it. It is found also in some vegetable essential oils.

Wax, as it is obtained from honeycomb, is of a dark-yellow colour, owing to its admixture with some honey and what is termed bee-bread. It has an aromatic odour, arising from the same admixture; for pure Wax is inodorous and insipid. It is purified by being fused and drawn out into ribbons, and afterwards exposed to the light and air. By this process it is whitened; and is then melted in water, acidulated with sulphuric acid, and thrown into moulds, to acquire the round and disc-like shape of the WHITE WAX, *Cera alba*, L. E. D. in which it is usually sold. By this process, not only is the colour discharged, but, as purified Wax is of a less specific gravity than yellow Wax, we may conclude that something is lost during its bleaching. Chlorine bleaches it when applied to it in combination with water. Unbleached or YELLOW WAX, *Cera flava*, L. E. D. is brittle, but not hard, is ductile and unctuous, and does not adhere to the fingers. When cut, it presents a peculiar surface, which is termed *waxy-lustre*: its sp. gr. is 0·96; it fuses at 150° Faht. and boils at 300°. It is insoluble in water, and only partially soluble in boiling alcohol or ether; and the greater part of the Wax is precipitated as the solutions cool: what is retained is precipitated by water. Both the fixed and the volatile oils dissolve Wax when aided by heat: with the former, it constitutes cerates and ointments. Boiled with the fixed alkalies, it

forms a soap, which is a simple combination of the Wax and the alkali; for when an acid is added to the saponaceous compound, the Wax is separated in its natural state. The acids scarcely act on Wax.

According to the experiments of Dr. John, when bees-wax is treated with boiling alcohol, it is separated into two distinct substances, *cerin* and *myricin*. The former constitutes 70 per cent. of the Wax, is of the consistence of Wax, of the same specific gravity as water, melts at 143° Fahr. is insoluble in water and in cold alcohol, but soluble in boiling alcohol, precipitating, however, as the solution cools. With potassa it yields margaric acid. *Myricin* is somewhat glutinous, of less specific gravity than water, and insoluble in water, alcohol, or ether, even when hot. The former of these substances gives brittleness to Wax, the other unctuosity. It does not saponify with potassa. Dr. Ure asserts that the ultimate components of Wax are 80·4 of carbon, 11·3 of hydrogen, and 8·3 of oxygen, or 13 eq. of carbon = 79·16, + 11 of hydrogen = 11, + 1 of oxygen = 8, making the equivalent 98·56. According to this analysis, Wax contains less oxygen than the fixed oils. Hess gives its composition $C.^{20}$ $H.^{20}$ $O.^{6}$, equiv. = 150·40.

Wax is often adulterated. When it is very brittle, and the colour of the mass is a light grey, inclining to yellow, there is a reason to suspect that it is mixed with peas-meal; when the fracture is smooth, shining, and vitreous, it contains resin, which may be readily detected by putting a small quantity of wax into cold alcohol: the resin is dissolved, whilst the Wax remains unacted upon. An admixture of *tallow* is detected by the exhalation of a disagreeable, suffocating smell when the Wax is melted.

Wax, combined with soap and mucilaginous solutions, is employed as a Demulcent in the tenesmus of dysentery; but it possesses little demulcent virtue. The best formula for prescribing it is that of Dr. Monro. He orders three drachms of *bees-wax*, one drachm of Castile soap, and one fluid ounce of water, to be melted together over the fire in a tin vessel, stirring the mixture until the ingredients are perfectly mixed. The whole is then to be poured into a mortar, and gradually incorporated with a pint and a half of water, and two ounces of syrup of marsh mallows. The dose of this compound is two or three table-spoonfuls, repeated at the intervals of three or four hours. It has been recommended in diarrhœas; but, if these are passive, or depend on simple debility of the viscus, such a composition as this must increase the evil: if they arise from inflammation or any other active cause, it is not easy to see how such a remedy can prove beneficial, although it is not difficult to conjecture that it would prove hurtful if it passed unaltered to the diseased surface. Its chief use is in the formation of plasters, cerates, and ointments. The following are Emollient:—

Wax Plaster. *Emplastrum Ceræ.* L. *Emplastrum simplex.* E. *Emplastrum attrahens.* D.—It is made by melting together lb. iii each of *wax* and *suet*, and lb. i of *resin*, and stirring the mixture until it is cold. The Edinburgh College orders ℥iii of *bees-wax* and ℥ii each of *suet* and *resin*.

Simple Cerate. *Ceratum.* L. *Unguentum simplex.* E. *Unguentum Ceræ albæ.* D.—Take f℥iv (f℥vsss, E.) of olive oil; ℥iv (℥ii, E.) of wax: melt and make an ointment.

Simple Liniment, *Linimentum simplex,* E. is formed by dissolving with a gentle heat *one part* of white wax in *four* parts of olive oil. A good emollient.

* * VEGETABLE SUBSTANCES USED AS DEMULCENTS.

a. GUM.

Gum is one of the earliest of the vegetable secretions, being the first change of the sap into a distinct substance. It exudes either spontaneously or from incisions, from the bark of certain species of trees, and concretes by exposure to the air. Almost all gum-bearing trees have astringent barks. The general characters of Gum, in the dry state, that in which we are most familiar with it, are semitransparency, brittleness, insipidity, inodorousness, and solubility in water. When very pure, it is nearly colourless; but some of the varieties are yellowish. Its specific gravity is greater than that of water, being 1·355. It does not undergo any change when kept in a dry place; but, when moist, it becomes mouldy. Exposure to the light blanches it. Heat softens and swells it, but it does not melt; on the contrary, in is charred, emits a bluish flame, and a light charcoal remains in the retort: in a high temperature, it is consumed, leaving a white ash, which consists chiefly of carbonate of lime and of potassa. The solution in water does not undergo any material change; for, when the water is evaporated, the Gum is obtained unaltered. When it is long kept in this state, if the mucilage it forms be not too thin, it will keep unaltered for years; but, if thin, it acquires an acetic odour and taste, and becomes mouldy on the surface. Its solution precipitates and decomposes some of the metallic salts: thus, with diacetate of lead, it forms a copious coagulum, which consists of 38·25 parts of oxide of lead and 61·75 of Gum; the acetic acid being left in the water. It unites readily, without any obvious change, with all the alkalies when unaided by heat; but, when liquid pure potassa is employed and the mixture heated, it converts the Gum into albumen; and, when the watery part is evaporated, the residue has all the characters of albumen treated with heat, and is equally insoluble. M. Raspail, who first remarked this result of the action of the alkalies on Gum, asserts that the alkali actually converts the Gum into true albumen, which he conceives to be

a compound of Gum and potassa, even when it is the product of animals. It certainly resembles animal albumen in the following property:—when exposed to a high temperature, it is incinerated with difficulty, whereas nothing is so easily carbonized as Gum; but, according to Raspail, it is the alkali which, both in the albumen and the alkalized Gum, resists the incineration. This is certainly a very remarkable fact, and demonstrates the existence of an affinity between vegetable and animal products.

The mineral acids act powerfully upon Gum; the sulphuric decompose it, resolving it into charcoal, tannic acid, water, and acetic acid; the hydrochloric produces a brown solution, which lets fall a charry matter, and the Gum approaches to sugar in its properties; but the most remarkable effects are produced by nitric acid. If this acid and Gum be slightly heated until a solution is formed, and a little nitrous gas be evolved, the solution on cooling deposites *mucic* acid; and *malic* acid is formed at the same time. If a greater quantity of acid be used, and the heat longer continued, the Gum is changed into *oxalic* acid. When alcohol is poured into a solution of Gum, it precipitates the Gum, by attracting the water of solution; at least, this is the explanation of the phenomenon given by the chemists. Gum is insoluble in oils; but, when triturated with them, they are rendered miscible with water—a fact which is very useful in prescribing these unctuous bodies.

When Gum is exposed for a long time to a temperature of 212°, it loses, according to Dr. Prout, all the water not essential for its composition; but, even in this state, it consists of carbon 41·4, and water 58·6, in 100 parts. According to the analysis of Gay-Lussac and Thenard, 100 parts of Gum consist of 50·84 of oxygen, 42·23 of carbon, and 6·93 of hydrogen, = 100·00. If these analyses be correct, we may with much probability suppose that Gum is the product of the decomposition of water in the vegetable system, and the union of its components with the carbon taken in with the fluid of the soil in a state of solution.

Gum is the production of a great variety of plants.

GUM ARABIC. *Acacia.* L. *Acaciæ Gummi.* E. *Gummi Arabicum.* D.—The Acacia yielding this gum grows on the Atlas mountains, and at Bled-eljerrede. It belongs to the natural order Leguminosæ*. This plant was formerly named *Sant* by the Egyptians. It is a low spinous tree, of a hard, withered aspect. The leaves consist of two pairs of pinnæ, each containing 8 to 10 pairs of oblong linear leaflets; and a gland between the pinnæ. The flowers are in auxiliary, globose, stalked heads, generally two together; the fruit is a moniliform legume. The stem is covered with a grey bark, from which the gum exudes

* London Dispensatory, art. Acaciæ. Richard, Hist. Nat. Med. ii, 5. Hayne, x, 34. Lindley, 269.

spontaneously, in a soft, semifluid state, and hardens in the atmosphere without losing its transparency. Many other species of Acacia, especially A. *Arabica*, A. *Seyal*, A. *tortilis*, A. *Ehrenbergii*, and A. *Senegal*, yield Gum. It may be regarded as a diseased secretion of the plant. That which is known as *Turkey Gum*, is imported chiefly from the Levant and Alexandria, and is regarded as preferable to *Barbary Gum*, which is the production of the A. *gummifera*, and is brought from Mogadore. The *Senegal Gum*, which is very inferior to the two former, comes from St. Louis, St. Mary's, and other places on the Gambia. When collected, which is about the middle of March and December, the gum has a faint smell; and, after being stowed in the warehouses, cracks spontaneously. The best Gum Arabic exported from Morocco is procured from the province of Saso and that of Abda. It is often mixed with Gum Senegal, which is the production of the Acacia *Senegal**.

Good Gum Arabic is in irregular, different-sized masses; it has a very pale straw colour, breaks with a vitreous fracture, is transparent, inodorous, insipid, and feels viscid in the mouth. When dissolved in water, a small portion of insoluble matter is left, which contains nitrogen. According to Gerin, Gum contains *Arabin*, *bassorin*, *bimalate* of *lime*, and *chloride* of *Calcium*, besides *chloride* of *potassium*, and *acetate* of *potassa*.

Besides the general components of Gum, this species contains a small portion of gluten, easily detected by rubbing the Gum with a spirituous solution of guaiacum, which evolves a blue colour. The change is gradual, first to a pale green and ultimately to a deep cerulean blue. This is perhaps the most perfect test of the distinction between gum and mucus; next to this is the precipitate caused by diacetate of lead; then that by silicated potassa; and, lastly, that by alcohol, which precipitates Gum in white opaque flakes, and merely coagulates mucus. Such are the distinguishing features of Gum and mucus. Gum Arabic is often mixed with the Gum of another species of Acacia, a native of Hindostan, Ceylon, and also of Arabia, the Acacia *Arabica* of Roxburgh. This Gum is collected in the dry season, and is used as an article of diet by the poor Hindoos, mixed with the seeds of the sesamum, after the oil is expressed from them. Another species of Gum, which resembles that of the Acacia *vera* in its properties, is obtained from Feronia *Elephantum*, the wood apple tree of Roxburgh; a tree belonging to the natural order Aurantiaceæ, and a native of the woods and mountainous parts of India, and of Ceylon, near Colomba. The Gum exudes from wounds made in the bark; and is so pure and transparent that Roxburgh says " Mr. Smart, the miniature

* Lindley, 269.

painter, told him it exceeded every thing he had ever seen for mixing with his colours*." This Gum is employed for medicinal purposes all over India: for it is never brought to England as an article of commerce.

The demulcent properties of Gum were very early known. Dioscorides mentions that it obtunds the acrimony of medicines with which it is mixed. If we enter into the examination of the effects of the digestive powers of the stomach on Gum, we shall find that, unless it be combined with a bitter, it is seldom digested, and not unfrequently passes through the stomach and bowels unaltered. This, in a great measure, secures its power as a Demulcent. In opposition to this opinion, may be stated the fact mentioned in Hasselquist's Voyages, that a large caravan of Abyssinians would have starved if they had not discovered a stock of Gum Arabic amongst their merchandize—on which alone 1000 persons subsisted for two months. Whole towns of negroes in Africa, also, subsist upon Gum in seasons of scarcity; and the Arabs who collect the Gum subsist upon it during the period in which they are thus employed†. Yet dogs, as an experiment of M. Majendie proved, soon perish if fed only on Gum. The animals quickly lose flesh; they become dull, retain no relish for food in the second and third week, and generally die about the 32nd or 33rd day of the experiment‡: but it should be recollected that the dog is a carnivorous animal.

The effects of Gum as a Demulcent is well confirmed; it is useful in the inflammatory stage of gonorrhœa; in strangury from the absorbtion of cantharides and other acrid matters which pass into the circulation and are excreted by the kidneys; in catarrh, to sheath the fauces; and as an enema, combined with milk or other animal juices, in tenesmus. In whatever form Gum is administered, it ought to be thick, so as to admit of dilution in the juices of the stomach, if we are to expect any benefit from its employment as a demulcent.

Gum may be administered in powder in doses of ℈ss to ʒi. It is ordered also in the following officinal forms:—

Mucilage. *Mistura Acaciæ.* L. *Mucilago.* E. *Mucilago Gummi Arabici.* D.—Is made by dissolving ℥x of powdered Acaciæ Gum in Oi of boiling water; and straining the solution through linen or calico.

Mixture of Acaciæ. *Mistura Acaciæ.* E.—Mucilage f℥ii, sweet almonds ʒx, pure sugar ʒv, water Oii. The almonds are decorticated by steeping them in hot water, and then beating them up with the sugar, mucilage and water, and straining.

Lozenges of Gum, *Trochisci Acaciæ*, E. are made with ℥iv

* Plants of the Coast of Coromandel, fol. vol. ii, p. 20.
† Lind on the Diseases of Hot Climates.
‡ Majendie's Elemens de Physiologie, &c.

of gum, ℥i of starch, and lb.i of pure sugar; powdered and made into a mass, with rose water, fit for making into lozenges.

e. Mucus (*vegetable*) is more generally extended over the vegetable kingdom than Gum. It is found in the roots, leaves, and seeds of many plants; and, in its purest state, greatly resembles a solution of Gum in its physical properties. Dr. Bostock first pointed out two of the distinctions which mark the difference between Gum and Mucus. I have already mentioned another, guaiacum.

Mucus varies according as it is procured from different plants, and parts of plants.

* ROOTS.

1. The Roots of Marsh Mallow. *Althœæ officinalis radix.* L. E. D.—This well-known plant, which belongs to the natural order Malvaceæ*, is indigenous; the root is perennial, and the herbaceous part annual. It is cultivated both in Germany and in France for medicinal purposes, and is imported into this country. The root is fusiform, white in the interior, and covered with an ash-brown epidermis. Every part of the plant abounds with mucus; but it is most plentiful in the roots. When these are steeped in cold water, the mucus alone is extracted; but when they are boiled, the mucus is mixed with fecula. According to the analysis of M. Bacon, of Caen, and others, Marsh Mallow roots contain—*gum* or *mucus; uncrystallizable sugar; fat oil; starch; glutinous matter*, a peculiar crystalline matter which he named *althein*, resembling asparagin or glycirrhizin; *malic acid; albumen;* several *salts;* and *lignin*†.

Mucilage of Marsh Mallows is a simple Demulcent; and may be administered *ad libitum* by the mouth; or as an enema in all cases of abrasions or irritations of the intestinal canal. The officinal preparations of this root are decoction and syrup.

Decoction of Marsh Mallow, *Decoctum Althææ*, D. *Mistura Althææ*, E. is a decoction of ℥iv of the root, with or without the herb of Marsh Mallow, and ℥ii of stoned raisins, in Ov of water, reduced to Oiii, and strained. It forms a useful and not unpleasant Demulcent, and may be taken *ad libitum.*

Syrup of Marsh Mallows, *Syrupus Althææ*, L. E. D. is a decoction of the root made into a syrup with pure sugar; then strained; and, after the feculencies have subsided, boil down to a proper consistence. It readily ferments, and possesses no advantage over common syrup.

On the Continent, a Demulcent lozenge is prepared with it, named *Pâte de Guimave.*

* London Dispensatory, art. Althæ. Lindley, 143. Richard, Hist. Nat. Med. ii, 725. Hayne, ii 25.

† Journ. de Chim. Med. t ii, p. 551.

* * LEAVES AND FLOWERS.

1. THE LEAVES OF COMMON MALLOW. *Malva.* L. E.—This plant is found in almost every quarter of the globe; it is a common weed on the sides of roads and around fields in this country, flowering from June to September. It belongs to the natural order Malvaceæ*. All the parts of the plant yield mucus; and, when boiled, tincture of iodine demonstrates the presence of starch in the decoction, which is also deepened in colour by the per-salts of iron; and forms precipitates with the salts of lead. The flowers being delicate tests of the presence of alkalies and acids, any addition of these substances to the decoction gives it a green or a red colour, as the one or the other is used. The decoction is employed as a fomentation in abrasions, and as a glyster in dysentery.

COMPOUND DECOCTION OF MALLOW, *Decoctum Malvæ compositum*, L. is made with ℥i dried Mallow, ℥ss of Chamomile flowers, and Oi of water, boiled for a quarter of an hour, and strained.

2. An East India plant, Gmelina *parviflora*, contains so much mucus, that a thick viscid mucilage, which may be used as gum, is obtained by steeping a few of the leaves in cold water for eight or ten hours.

* * * SEEDS.

1. LINSEED AND LINSEED MEAL. *Lini Semina.* L. E. D. *Lini Farina.* E. D.—The Lint or Flax plant, belonging to the natural order Linaceæ†, of which it is the type, is generally cultivated in Britain; but it orginally came from the banks of the Nile. The seeds used in this country are imported chiefly from the Baltic. The plant is readily distinguished by its slender, smooth, round stem, seldom exceeding two feet in height; its small, sessile lanceolate, narrow, alternate leaves; its loose panicle of blue-streaked flowers; and its globular capsule terminated with a spine, containing, in five cells, many flat, elliptical, mahogany-brown, shining seeds, with white oily cotyledons.

The mucilage resides in the testa of the seeds, one ounce of which, infused in ten fluid ounces of water, forms a colourless, viscid mucus, which is coagulated by alcohol, diacetate of lead, and chloride of tin; but it produces no change on silicated potassa, nor the salts of iron, nor the decoction of galls, nor chlorine, nor iodine. This mucus soon gets ropy and spoils. M. Vauquelin examined it, and found that it consists of gum, combined with an *azotized matter*, *acetic acid*, *acetates of potassa* and *lime*, *sulphate of potassa*, and *chloride of potassium*, some

* London Dispensatory, art. Malva. Hayne, ii, 28. Lindley, 142.
† Ibid. art. Linum. Hayne, viii, 17. Lindley, 129.

phosphates, and *silex*. Owing to the presence of the free mucilage in the acetic acid, it reddens litmus.

It is a simple demulcent, possessing no advantages, except cheapness, over mucilage of Acacia Gum.

INFUSION OF TEA OF LINSEED. *Infusum Lini compositum.* L. E. *Infusum Lini.* E.—Take of Linseed, ʒvi (℥i, D.); Liquorice Root, bruised, ʒii (ʒiv, D.); boiling water, Oi (lbs. ii, D.); digest in a lightly covered vessel and strain. The London and Dublin Colleges order the Linseed to be bruised, which makes the infusion turbid, oily, and disagreeable, without rendering it more demulcent. It may be taken ad libitum.

LINSEED MEAL, *Farina Lini*, E. is the cake remaining after the expression of the oil from the seeds, ground into powder. It is an excellent article for making poultices. The Dublin College, in its formula of a POWDER FOR POULTICES, *Pulvis pro Cataplasmate*, add two parts of Oatmeal to one part of Linseed meal.

LINSEED MEAL POULTICE, *Cataplasma Lini*, L. is merely a soft paste, made by stirring boiling water with Linseed meal.

2. QUINCE SEED. *Cydonia.* L.—The plant which yields this seed belongs to the natural order Pomaceæ, and is a native of Crete*. The fruit is about the size of a large round pear, yellow, and downy on the surface, the seeds are flat on one side, convex on the other, and of a reddish-brown colour. The testa of the seeds abound with mucus, which is readily abstracted by boiling water, an ounce of them being sufficient to render a pint of water viscid. They contain tannic acid. When the seeds are boiled, the decoction contains, besides the tannic acid, *mucus*, *bassorin*, and *fecula;* on which account the mucilage rapidly ferments. Acids and metallic salts coagulate the mucus of Quince seed; consequently, they are incompatible in prescriptions with it. But no change is effected on it by silicated potassa, oxalate of ammonia, nor astringent infusions or decoctions. The decotion is the officinal preparation.

MUCILAGE OF QUINCE SEED, *Decoctum Cydoniæ*, L. is made by boiling ʒii of Quince Seeds in Oi of Distilled Water for ten minutes, and straining. It is chiefly used as an emollient application in ophthalmia and sore nipples.

All the varieties of mucilage which have been described, with the exception of that procured from the leaves of the Gmelina *parviflora*, were well known to the ancients. The mucilage of the linseed, in particular, on account of its cheapness, has always been in common use. In preparing it, the custom is to boil the seeds in water; but this is not only un-

* London Dispensatory, art. Cydonia. Richard. Hist. Nat. Med. plate ii, page 466. Hayne, iv. 47. Lindley, 234.

necessary, but improper, as some of the fixed oil contained in the cotyledons is extracted, and gives a nauseous taste to the mucus. In all visceral inflammations, particularly in those of the kidney or the bladder, in gonorrhœa, ardor urinæ, and tenesmus, the *mucilage of linseed* has been found very useful, whether administered by the mouth or as an enema. Dioscorides particularly notices the mucus of the *marsh-mallow* in affections of the urinary bladder. Both the leaves of the Althæa and those of Malva, when well boiled, form excellent emollient cataplasms in abrasions, and in some cutaneous eruptions in which a sharp ichorous discharge takes place. They form excellent vehicles for the hydrocyanic acid, as an external application, when there is much irritation in impetigo. The *mucus of the quince* is employed in aphthous states of the mouth, and in inflammation of the eye, when the lachrymal discharge is sharp and acrid, and as an enema in tenesmus and chronic diarrhœa. These mucilages, as internal remedies, are less useful than the mucilage of gum arabic, inasmuch as they are more digestible, and therefore less likely to pass into the system undecomposed; this is especially the case with the quince mucilage, which contains a bitter principle that aids the influence of the stomach upon the mucus.

g. TRAGACANTHIN.

This principle closely resembles *Arabin*, and is the soluble part of Tragacanth; but it differs from Arabin in not being precipitated by silicated potassa, nor by perchloride of tin. It is, however, precipitated by diacetate of lead, chloride of tin, and proto-nitrate of mercury. Oxalate of ammonia detects lime in it.

1. TRAGACANTH. *Tragacantha.* L. E. *Gummi Tragacanthæ.* D.—This is the production of various species of Astragalus; but chiefly A. *verus* and A. *Creticus*, plants which grow abundantly on Mount Olympus and in Iona and Crete, belonging to the natural order Leguminosæ*. Tournefort describes the plant which he saw on Mount Ida, and details the manner in which the Tragacanth is collected; but, notwithstanding the time that has since elapsed, there is still doubt respecting the precise species of Astragalus which yields this exudation. The Astragalus *Tragacantha* and A. *Gummifer* of Labillardeire are supposed to be the plants; whilst some refer it wholly to the Astragalus *verus* of Olivier: perhaps, all of them yield Tragacanth. It is gathered in autumn: its exudation, which occurs in summer, is more or less abundant according to the heat of the weather; it exudes in tortuous filaments or ribands, the form in which it comes to this country. That which is collected in Persia is sent

* Richard, Hist. Nat Med. t. ii, p. 492. Hayne, x, vii, viii. Lindley, 247.

to Bagdad, Bassorah, and Russia: that which comes to this country is exported from Smyrna and other parts in the Levant.

The qualities of Tragacanth which distinguish it as being good, are whiteness, semitransparency, brittleness, insipidity, and inodorousness. Although brittle, yet it is not easily pulverised, unless during frosty weather and in a heated mortar. According to Guerin-Varry, it contains 53·39 per cent. of *Arabin* (or *Tragacanthin*), 33·10 of *Bassorin* and *Starch*, and 11·16 of *Water*; the insoluble part is Bassorin. The same chemist has given the following ultimate analysis of both its components:

	Soluble.	Insoluble.
Carbon	42·01	35·79
Hydrogen	6·43	7·11
Oxygen	54·57	57·10
	100·00	100·00

Tragacanth is demulcent. It is ordered in the following forms:

COMPOUND POWDER OF TRAGACANTH. *Pulvis Tragacanthæ compositus*, L. E. is a compound of powdered Tragacanth, powdered Acacia, and Starch, each ℥iss; and ℥iii of Sugar. The Sugar and Starch are first rubbed together, and then the Tragacanth and Acacia added. It is not easy to understand why the Colleges order a compound powder which contains starch—a useless ingredient, as it is not soluble in cold water. This powder is given in doses of ʒss to ʒi.

MUCILAGE OF TRAGACANTH. *Mucilago Tragacanthæ*. E. *Mucilago Gummi Tragacanthæ*, D. is made by macerating ʒii of Tragacanth in f℥ix of boiling water. Two drachms of Tragacanth thickens a pint of water as much as an ounce of gum; but the best proportions for internal use are a drachm of Tragacanth to eight fluid ounces of water.

h. CERASIN AND BASSORIN.

Cerasin derives its name from *Cerasus*, the name of the genus of plants which yield the cherry. It forms one part of the gum that exudes from the bark of the cherry-tree, in small quantity and very impure.

The gums containing Cerasin are generally in pieces, resembling vermicular fragments, less transparent than gum arabic, snd not so easily pulverized, but equally insipid and inodorous. They are nearly insoluble in cold water; but they imbibe water, swell, and form a thick, gelatinous mixture: if cold water, however, be acidulated with any of the mineral acids, a portion of the Cerasin is dissolved. In boiling water, the gelatinous mixture of the Cerasin and water is dissolved; but, as the

liquid cools, the gelatinous part is again precipitated: if the acidulous mixture, however, be heated, nearly the whole is permanently dissolved. According to Bucholz, a German chemist, Cerasin consists of 57 parts of a matter resembling gum, and 43 parts of a peculiar matter, insoluble in cold water, although it imbibes that fluid and swells like a sponge; but it is soluble in boiling water, in which it forms a permanent mucilage. According to the analysis of Guibourt, the portion dissolved in cold water differs from gum in collecting into an opaque mucous mass, when it is precipitated by alcohol, which is not the case with gum; whilst the insoluble portion, he says, has some affinity to starch in striking a blue colour with tincture of iodine. This latter portion, in some of these gums, has been named Bassorin, from being found abundantly in *Bassorah* gum.

There are two varieties of gum containing Cerasin and Bassorin; namely, *Cherry-tree Gum* and *Bassorah Gum;* neither of which is officinal.

1. Cherry-tree Gum. *Cerasi Avii Gummi.*—Besides being procured from the cherry-tree, this gum exudes from the bark of the Apricot and the Plum-tree. It is too well known to require any particular description. As it exudes from the bark, it is variously coloured by the other secretions of the bark: hence, Cherry-tree gum, were it even obtained in sufficient quantity for medicinal and other purposes, is too impure to supply the place of tragacanth. It consists chiefly of Cerasin; and, from the circumstance of Dr. John having discovered this product in Cherry-tree Gum, the whole received from him the name of Cerasin. It displays nearly all the chemical characters of tragacanth, with the addition of a little tannic acid.

2. The Gum of Bassorah. *Gummi Bassoræ.*—This is the production of an unknown plant. M. Virey, in a paper which he published in the Journal de Pharmacie, has conjectured that it is a species of Mesembryanthemum; but upon what foundation does not appear. It is brought from the neighbourhood of the city of Bassorah; whence its name: but it is, occasionally, found mingled with the gum arabic of the Coast of Barbary. It is in irregular masses, of a yellowish hue, less transparent than gum arabic, but more so than tragacanth. It is insipid, and does not produce so thick a mucilage as tragacanth. It swells like tragacanth when put into water; but it does not form a cohesive mucilage. It appears to be composed of a vesicular matter, which, after it swells in water, separates like little granules, and does not appear to be susceptible of cohesion. This vesicular matter, which is insoluble in water, is not coloured blue by iodine; it is soluble in water acidulated with nitric acid. Treated with potassa, ammonia is disengaged. If the Gum of Bassorah be treated with water, alcohol, and ether, it leaves this substance, which is *Bassorin*, in a state of purity. Vauquelin,

who has particularly examined this substance, found it in the Gum of Bassorah, and named it; Pelletier has found it in *assafœtida, euphorbium, bdellium,* and *sagapenum;* Braconnot in the *bean of St. Ignatius;* and Caventou in *opium.*

The Tragacanth is the only one of the preceding gums generally used in medicine. As it forms a thicker mucilage than gum arabic, it has acquired the character of being a better Demulcent; but, from its approximation to fecula, I am disposed to think that it is more digestible than gum, and therefore is less demulcent when it is taken into the stomach. As a local Demulcent, it is preferable to mucilage of gum; but, upon the whole, all the purposes of a Demulcent, whether general or local, are obtained from Gum Arabic; consequently, it is unnecessary to load the list of Materia Medica with other vegetable gums for this purpose.

i. SARCOCOL.

This is the concrete juice of the Penæa *sarcocolla,* a plant which is a native of Africa. Sarcocol was known to Dioscorides, who states that it is the tears of a tree which is a native of Persia; that it resembles the farina of frankincense, is reddish, yellow, and is bitter to the taste; and that it is often adulterated with gum. It is generally in small yellowish grains, and has a peculiar odour, not unlike that of anise-seed. The pure Sarcocol which the samples of this vegetable matter generally contain does not exceed eight parts in ten; the other two parts are impurities of various kinds, but chiefly cerasin. Sarcocol has a sweet taste, which changes to a bitter. The watery solution is viscid. Its solution is precipitated by infusion and tincture of galls. Nitric acid causes a slight effervescence, and throws down a white precipitate. Silicated potass causes no precipitate, but colours the solution green; as do all the alkalies. Sulphate of iron slowly forms a precipitate, and diacetate of lead an immediate and copious one. This circumstance of being precipitated by tincture of galls distinguishes Sarcocol from gum and mucus, and approximates it to starch, which yields a gallotannate when treated with hot infusion of galls and allowed to cool.

It has been supposed that the Extract of liquorice, or Spanish juice, as it is termed, owes its taste and peculiar properties to Sarcocol; but Robiquet, who analysed the French root of Liquorice, calls its saccharine principle *Glycirrhizin**.

LIQUORICE ROOT. *Glycirrhizæ Radix.* L. E. D.—EXTRACT OF LIQUORICE. *Glycirrhizæ Extractum.* E.—The Glycirrhiza *glabra* is a plant belonging to the natural order Leguminosæ†.

* Ann. de Chim. et de Phys. lxxii, 143. Hayne, vi, 40. Lindley, 243.
† Richard, Hist. Nat. Med.

This plant is a native of Syria, cultivated abundantly in Spain and in this country. The root is long, creeping, cylindrical, and, when full grown, about the thickness of the human thumb. The stem rises from two to four feet in height, giving off large, unequally-pinnate, yellowish-green, viscous leaves; and, from their axillæ, racemose, papilionaceous flowers, which are succeeded by smooth, four-sided legumes. When it is three years old, the roots are supposed to be at their perfection; they are then dug up for use. Dr. Russell, in his History of Aleppo, informs us that a decoction of the roots of the liquorice plant is drunk cold in summer, in the manner of sherbet. By decoction, these roots yield the well-known extract *liquorice*, or *Spanish juice*, which is chiefly prepared in Spain, whence it is imported in rolls covered with laurel leaves. It is afterwards refined, and formed into small cylinders, which are glossy, brittle, and break with a vitreous fracture. It consists of *asparagin*, *mucus*, *charcoal*, *glycirrhizin*, and an *oleo-resin*. The *glycirrhizin* is converted into artificial tannin when the liquorice is dissolved in nitric acid; and when dissolved in sulphuric acid, the charcoal left amounts to one quarter of the weight of the liquorice employed. The *glycirrhizin* may be procured in the form of a yellow, transparent, brittle mass, which, when heated, swells, burns with a clear flame, and gives out smoke. The solution of this saccharine matter in water is precipitated by all the acids; but none of the acids appear in the precipitates.

As a Demulcent, Extract of liquorice is useful for smearing the fauces and allaying the tickling cough which often accompanies catarrh. It is also useful, although in an inferior degree, when taken into the stomach, as it involves there acids and many things that are detrimental. In heartburn, a piece of liquorice often affords very considerable relief.

The root is prescribed in the form of Decoction, the Extract in solution, and in Lozenges.

Decoction of Liquorice, *Decoctum Glycirrhizæ*, D. is made by boiling ℥iss of the root, bruised, in lb. i, by measure, of water, for ten minutes, and then straining. It is merely used as a vehicle for more active medicines.

Liquorice Lozenges, *Trochisci Glycirrhizæ*, E. are compounds of *six parts* each of Extract of Liquorice and Gum Arabic, and *sixteen parts* of pure sugar, made with boiling water into a paste of a proper consistence for making lozenges. They are useful to allay tickling coughs.

k. FIXED OILS.

As an article both of diet and of medicine, one of these oils, that of the Olive, has been known from the earliest periods to which the history of our species can be traced. As Demulcents,

th eFixed Oils are rarely given in an uncombined state, although the followers of the doctrines of Broussais, in France, have lately exhibited them in those affections of the viscera which they term gastro-enteric; and it is undoubted that, in their unmixed state, the Fixed Oils are not readily digested, but continue separate from the other contents of the stomach, and hence are well adapted to act as Demulcents. When taken into the stomach in a combined state, such as occurs in the productions of nature—in the emulsive seeds, for instance—they are wholly converted into chyme, and of course do not pass the pylorus as oils; so that they cannot exert any demulcent effect; but when they are not blended with other substances, that is not that case, and they become useful medicinal agents. Much, however, depends on the manner, and even on the dose, in which they are given; for oil which, in small doses, acts as a Demulcent, in large doses proves either emetic or purgative. When given as Demulcents, the fixed oils are generally combined with other substances, either by the hand of nature or by art: it is in this latter state that we have now to examine them.

When artificially prepared as Demulcents, fixed oils are generally combined with water, either by means of mucilage of gum or of alkalies. When the first is used, the oil is simply diffused through the fluid in a state of minute division, and the mixture is easily decomposed; with the other, a soap is formed, which is more permanent. In the first state, the oil is more easily digested as it approaches to the condition of natural emulsions, or those formed by triturating demulsive seeds with water. In the saponaceous compound, on the other hand, oil is a useful Demulcent; and, although I cannot exactly explain the manner in which it produces its effects, experience has sufficiently confirmed its utility to authorize its recommendation. The only seed employed for forming emulsions is the almond.

The Sweet and the Bitter Almond. *Amygdalæ dulces —Amara.* L. E. D.—The Almond tree is a native of Syria and the coast of Barbary; but it is now naturalized in the south of Europe, and cultivated as an ornamental tree in this country, where, however, it does not ripen its seeds. Almonds are imported in the shell or *endocarp;* the seed itself, or the almond, differs in appearance according as it belongs to one or other of the varieties known in the market.

The best of the *sweet almonds* are brought from Malaga, under the title of *Jordan* almonds. They are about an inch long, more or less flat, with a brownish cuticle, sweet and mucilaginous to the taste, and inodorous. *Valentia almonds* are broader, shorter, and flatter than the Jordan, and covered with a dingy-brown pulverulent cuticle. The *Barbary* and *Italian* are maller and rounder than either of the former. Whatever may

be the variety, the almonds which are worm-eaten and rancid should be rejected.

The *bitter almond*, which, although smaller, yet does not differ much in appearance from the sweet almond, comes from Mogadore. It is generally considered as the produce of a distinct variety of the Amygdalus *communis*. Both varieties of the almond yield, when expressed, a considerable quantity of bland, insipid, inodorous oil, which, in the cotyledons of the almond, is united with gum, emulsin, and liquid sugar, in the sweet almond; and farther with amygdalin in the bitter. According to the experiments of M. Bouillay*, 100 parts of sweet almonds contain 54 parts of a *fat oil*, 24 parts of *albumen*, 6 *parts of sugar*, or rather a saccharine principle, and 3 *parts of gum;* but, according to Vogel, of 28 *of fixed air*, 30 *emulsin*, 6·5 *liquid sugar*, 3 *of gum*, and 32·8 *of testa* and *lignin*, = 100·06†. The albumen which the almond contains is supposed to approximate to the white of egg; but it differs very considerably from that animal substance. A very small proportion of white of egg diluted in water is immediately precipitated by a few drops of the solution of corrosive sublimate; whereas the same sublimate contributes to the permanence of the almond emulsion. Besides these components of the sweet almond, the bitter almond contains the elements of an essential oil and hydrocyanic acid, on which its flavour and odour depend: the hydrocyanic acid, as well as this oil, is evolved only when it is treated with water. The emulsion of the sweet almond cannot be regarded as a Demulcent, the quantity either of the oil or the gum being too small; but it is an useful and agreeable vehicle for other medicines. One of the chief constituents of this Emulsion, and constituting the albumen of the seed, is a principle which has been named *Emulsin*. The emulsion of the bitter almond may be employed in the same manner as that of the sweet almond; and the hydrocyanic acid, instead of being a disadvantage, from the sedative effect which it produces on the nervous system, renders it more useful, in catarrh and similar complaints, than the emulsion of the sweet almond. It must, however, be kept in view that many people suffer from eating bitter almonds, owing to the volatile oil acting on a peculiar idiosyncracy: the skin is rendered highly irritable, and an eruption closely resembling nettle-rash appears.

Olive Oil, *Olivæ Oleum*. L. E. *Oleum ex fructu*. D.—The Olive plant, Olea *Europæa*, belonging to the natural order Oleaceæ‡, is supposed to have been originally brought from Asia, although it is now naturalized in Italy, Spain, France, and

* Gmelin, Handb. of Chim. † Ibid. ii, 1268.
‡ Richard, Hist. Nat. Med. Hayne, x, 10. Lindley, 547.

other parts of the south of Europe. There are several varieties of the tree; but all of them yield the well-known bland, fixed oil, known under the name of the plant. It is a small tree, with hoary, rigid branches; ovato-lanceolate, mucronate, alternate leaves, green above and hoary below. The flowers are small, white, in short, axillary, erect racemes. The fruit resembles a damson in colour and in size; and encloses a sharp-pointed nut or stone.

The best known of all the bland vegetable oils is that which is yielded by the ripe fruit of the Olive. The oil and the mode of procuring it were very early known; and it was so much prized, that the plant became the emblem of Peace. The oil is obtained from the ripe fruit, gathered in November, and bruised in a mill, which does not crush the nut. The pulp is then pressed in bags made of rushes; the best oil flows first, and is termed *virgin oil;* the marc is then broken, moistened with warm water, and again pressed, and an inferior oil is obtained; and, lastly, the marc is again broken down, moistened, fermented, and pressed, or it is boiled to an extract, to obtain from it all the oil which it contains. It is necessary to leave the newly-drawn oil at rest for some time, to enable it to deposite a fibrous, albuminous matter, which is expressed with the oil.

The oil of Olives imported into this country comes chiefly from Lucca and the vicinity of Florence; some comes from Genoa; but the best oil is made in Provence, owing to the great care bestowed in cleaning and garbling the olives. A very inferior kind is exported from Sicily and Spain.

Olive oil, when pure, has the common characters of the fixed oils; it is the lightest of the fixed oils, its specific gravity being 0·913; whereas that of almonds and of linseed is 0·932, and that of the poppy 0·929. The purer the oil, the lighter it is, and the thinner. It is of a pale straw-colour; is inodorous, and has a bland taste. Olive oil concretes in a temperature of 30° of Faht.; almond oil remains fluid at a lower temperature; and poppy oil still lower; which differences in the point of concretion enable the adulteration of the oil of olives with poppy oil to be readily detected, by exposing the suspected oil to a freezing mixture, which congeals the oil of olives, but does not affect the oil of poppies. When shaken in a phial, pure olive oil soon loses the bubbles formed on it; but when adulterated with poppy oil, it retains them for some time. According to Braconnot, olive oil consists of 72 of oleine, + 28 of margarin, = 100*. The adulteration may also be detected by mixing the suspected oil with pernitrate of mercury. If the oil be pure, it will become totally consolidated in a few hours; whereas, if it be adul-

* Ann. de Chim. xciii, p. 340.

terated, this coagulation will not take place. The admixture of the poppy oil with the oil of olives hastens the rancidity of the latter.

Oil of almonds, which is obtained by macerating almonds and then expressing them without heat, is of a paler straw colour than the oil of olives. When first expressed, it is turbid; but it is cleared by filtration through coarse spongy paper, in a room kept at a rather high temperature.

The oils expressed from the seeds of plants are called *fat oils*. They are all insoluble in water; but form emulsions when triturated with yolk of egg, or with gum and water; and it is owing to the presence of mucilage in the cotyledons of the seeds, which yield oil, that they form emulsions when triturated with water. When a thin layer of oil is long exposed to the air, it forms a varnish; and this change occurs rapidly when the layer of oil is exposed upon water in close vessels to the action of oxygen gas: hence we conclude that this change in the oil exposed to the air arises from the absorption of its oxygen. But some oils, under these circumstances, do not lose their transparency; and on this account are used in the art of painting under the term *drying oils*. When the fat oils become rancid, they thicken, acquire a brown colour, and a disagreeable smell: carbonic acid and hydrogen are evolved, with some carbonic oxide. They acquire, also, acid properties, converting the vegetable blues into red; and water is evolved. This state has been supposed to depend, in a great degree, on the mucilaginous matter which is pressed out with the oil, and does not separate from it.

The only concrete fixed oil used as a Demulcent is that obtained from the kernel of the fruit of the Makaw tree, the Cocos *butyracea*. It is termed an oil, *palm oil*; but it is, in fact, a vegetable butter. It is used for external purposes only; and in this respect, however, it is not superior to lard and other animal fats, except that it has an agreeable odour.

The demulcent properties of the fat or fixed oils were very early known. They were chiefly employed with the aid of friction; and both Galen and Celsus have left many precepts for their application. The local emollient properties of the fixed oils are much augmented by the addition of caloric in quantity sufficient to produce a temperature between 65° and 98°. In this respect, the action of the fixed oil cannot be regarded in any other light than as a mechanical agent acting on rigid surfaces without regard to their vitality. To its emollient properties we ought to ascribe its effects in promoting the flow of the urine in ischuria or retention of urine, by rubbing it upon the lower part of the abdomen. We cannot account for this in any other manner than by supposing that the relaxing effect which the warm oil produces on the part to which it is

applied is communicated by sympathy to the sphincter muscles of the bladder, which, in this case, are spasmodically constricted. Cullen ascribes the benefit chiefly to the friction; but friction alone does not produce the effect which follows friction with warm oil. In noticing this emollient effect of caloric, combined with fixed oil, in ischuria, it is necessary to be careful that the stoppage of urine does not depend upon the paralysis of the bladder; as, in that case, the application of warm oil as an emollient would be productive of injurious consequences, by adding to the degree of relaxation which is the cause of the stoppage.

B. DEMULCENTS EMPLOYED DIETETICALLY.

The *Dietetical* Demulcents, noticed in the table, are all varieties of fecula or starch; in some of them, combined with gluten, albumen, and other vegetable principles. *Starch* is readily distinguished from gum and sugar in its raw state by it's opacity, its insolubility in cold water, and its forming a gelatinous mucus when it is boiled with water. Its solution in water soon loses its consistency, acquires an acid taste, and becomes mouldy; it should, therefore, never be kept in this state. It is insoluble in alcohol, which precipitates it from its solution; and it is also precipitated by tincture of galls, diacetate of lead, and barytic water; but the greater part of the metallic salts and silicated potassa do not act on starch. The most delicate test of its presence is iodine; but this acts only in a low temperature, heat decomposing the compound of iodine and the amidine of the fecula, or Iodide of Amidine, and destroying the colour. The varieties of fecula arranged in the table of Demulcents may be indiscriminately employed for supporting the strength in all diseases of increased action, and in convalescences from acute diseases. Among these varieties, the fecula of barley is the least, that of *salep* the most nutritious, owing probably to its containing a large proportion of saccharine matter.

SECTION II.

DILUENTS.—MEDICAMENTA DILUENTIA.

DILUENTS constitute an order of medicines of great practical importance; for, as they are beneficial in all febrile affections, and as fever is a general accompaniment of almost every disease, there is scarcely any deviation from health in the treatment of which they are not required. The name of the class

refers to the simple fact, that the substances contained in it are intended for diluting the fluids of the body. Were this the only result of their administration, very few remarks, indeed, would be necessary for explaining their influence; but their operation involves many inquiries of great interest, some of which have long divided the opinions of physiologists. On this account, in treating of Diluents, I shall enter more into details than might, on a cursory view of the subject, be expected.

The animal body is a compound of solids and fluids; consequently there must be maintained a certain relative proportion of these to constitute that state of the system which is denominated *health*. In a full-grown adult, the solid matter of the body, under which term we comprehend all that substantial part of the frame which is not in constant motion in the vessels, does not amount to more than one-fifth of the weight of the body: Richerand makes it one-sixth, and Chaussier only one-ninth: it must be recollected that there is a quantity of fluid combined with the solids in so intimate a manner as almost to constitute a part of their substance; and allowing the four-fifths only of this is water, yet, they do not appear wet. It is not chemically combined with the real solid matter, as it is lost by evaporation. The complete loss of water destroys the vitality of the animal solid. The quantity of water contained in the blood has not been accurately ascertained.

The diminution of the fluid part of the body, whether as regards the circulating mass or the solids, is the cause of an uneasy sensation, indicating the necessity of repairing the waste of fluids, which we familiarly term *thirst*. This is a sensation connected with some natural state of the corporeal functions, and altogether independent of the occasional excitement of foreign bodies, although it may be induced by these. In enquiring into the cause of thirst, as far as is necessary for our subject, we must distinguish *true* or *spontaneous thirst* from that demand for a certain supply of liquid which is the result of repletion of the stomach, and the cause of our drinking at our ordinary meals. It is not this *alimentary thirst*, if we may so term it, that is to occupy us at this time. True thirst occurs when we have been some time without taking drink; when the system has been greatly excited, whether by corporeal or mental causes; when acrid substances, particularly saline bodies, have been taken into the stomach; and in every condition of the system, from whatever circumstance it may proceed, which favours the excretion of fluids—as, for example, perspiration, diarrhœa, and diuresis. The immediate cause of thirst appears to be a dry state of the mouth and fauces; owing to the mucus which covers these parts becoming thick and viscid. This may arise from the absorption of the fluid parts of the saliva; for it appears to be necessary, for the due performance of the func-

tions of the palate and the tongue, that the mucus should possess a certain degree of liquidity. It is proper to observe, however, that some physiologists regard the sensation of thirst as altogether independent of any dryness in these parts, and contend that it is sympathetic of an uneasy state of the stomach. However this may be, the sensation is indicative of the necessity of a supply of fluid to the system generally; for although thirst may be momentarily assuaged by wetting the mouth or holding a thin fluid in it, yet it can only be effectually and permanently relieved by conveying into the stomach a quantity of fluid sufficient to supply the deficiency. This supply is termed *dilution*, from an idea that the liquid passes into the blood and renders it thin; hence the fluids themselves, which are taken under these circumstances, and with this view, into the stomach are termed *Diluents*. Thirst is not always indicative of a deficiency of fluids in the circulating mass; and the tongue and fauces are found to be occasionally dry and harsh, whilst the sensation of thirst is absent. Some individuals never experience the sensation of thirst. Sauvage mentions a member of the Academy of Toulouse who never thirsted, and passed whole months of the hottest weather without drinking. It is well known that many warm-blooded animals—namely, mice, quails, and parrots—drink very little*. In general, however, thirst is indicative of diminished fluidity of the blood; and, when it is not assuaged by taking liquids into the stomach, or by moistening the mouth with them, or by applying them to the surface, the torment which it induces occasionally amounts almost to phrenzy: on every occasion it is borne with less patience and greater difficulty than hunger. Sometimes inflammation of the mouth and throat and intense fever supervene. Various circumstances connected with the ordinary condition of the body influence the sensation of thirst. Thus, it is greater in infancy and childhood than in adult age, and less in old age; it is greater in women than in men; it is varied by constitution and temperament; by climate; season; the nature of the diet; exercise; passions of the mind, and even by imagination.

A certain relative proportion of the fluid to the solid parts of the body is, as we have already said, essential to health; it is only in a diseased state of the habit that the balance of that proportion is broken, and either a decrease or a diminution in the fluids occur. Thus, in health, if thirst induce a person to drink freely of any bland fluid, the excretory powers of the skin and the kidneys are augmented so as to throw off the superabundance in the form of urine and perspiration: and even in

* The defect of the sensation of thirst in these animals is supposed to depend on their having very large salivary glands, and a larger pancreas in proportion to the magnitude of their bodies, than is found in animals who require drink.

disease, when the thirst is augmented to an inordinate degree, as in *polydypsia,* in which patients have been known to drink sixty or seventy pints of fluids in twenty-four hours, the skin and the kidneys still maintain the relative proportion between the solids and the fluids. It is necessary, however, so far to modify the above statement as to admit that a temporary inequality may exist during health. When the fluids are deficient, drink is desired and taken, so that the balance is quickly restored: on the other hand, the kidneys and the skin rapidly restore the balance when the fluidity of the circulating mass is too much increased. Taking all these considerations into account, we may define Diluents to be—"Remedies which, rendering more liquid the contents of the stomach and the bowels, and, subsequently, the general mass of the circulating fluids, lessen the morbific effects of certain matters, contained either in the intestinal canal or in the blood, on sensible and irritable parts with which they come in contact." We are fully aware that the idea of acrimony in the blood is problematical: but as cantharidin, turpentine, iodine, and many volatile oils and other substances, are taken into the circulation, it is not improbable that acrid morbific matters are also received into it. We can readily comprehend that, when the stomach and bowels are disordered by acrid matters, Diluents may prevent or diminish their bad effects, by increasing the proportion of the fluid contents of these viscera. And it is very possible that, in disease, the natural constituent parts of the blood may be so altered as to produce a morbid impression on the vessels containing it, and thereby increase their general force or the frequency of their action: whilst the secretions formed from it are either in a diminished quantity, or have acrid and stimulating qualities, which they do not possess in a healthy condition of the body. Diluents, therefore, in this state of the blood, by augmenting, even for a short period of time, the quantity of water in the circulating mass, may render both it and the secretions more bland, and thus allay general increased excitement.

From these effects of Diluents, it will be understood that they are indicated in acrimonious states of the contents of the first passages, and in all cases of increased excitement. They are, therefore, advantageously administered in *fevers,* especially of the inflammatory type, in which, besides answering the abovementioned intentions, they remove another very considerable cause of irritation, the sensation of thirst. They are indicated in irritable states of the intestines, arising from bile and diseased secretions; in *dyspepsia,* proceeding from causes producing a very irritable condition of the coats of the stomach; in *dysentery;* in *cholera morbus,* particularly when occasioned by too great or too hurried a secretion of bile; and in *diarrhœa* kept up by acrid secretions from the intestines themselves. They are, also,

useful in many diseases of the urinary organs. When taken in large quantity, they cause the urine to flow abundantly, pale, and little stimulating, forming what is usually termed the urine of drink: so that when the concreted animal acid, the lithic, which forms the red sand-like matter collected in the pelvis of the kidney, in gravel, abounds, Diluents, by washing out that receptacle, assist in curing the disease. In local inflammations of the urethra, they are also useful, both by abating the acrimony of the urine, and carrying off the virus lodged in the urethra. There are, indeed, few diseases in which Diluents are not useful auxiliaries, by aiding the influence of other remedies—as, for example, that of cathartics, emetics, and diaphoretics.

All the substances usually employed as Diluents owe their properties, as such, solely to the water they contain: this fluid, therefore, is the only Diluent in the strict sense of the term. By its diluent property it maintains, or restores, the natural fluidity of the blood; consequently it promotes the circulation, softens down acrimonious matters in the secretions, allays irritation, and facilitates secretion itself. Much, however, depends on the quantity drank; for intemperance may even exist in the use of this natural and salutary beverage*. It is on the excess of water drunk by the supporters of Hydropathy, *Methodus Hydratica*, and the heterogeneous list of diseases treated by it, that the empiricism of the practice consists; for it is undoubted that, as far as concerns the drinking of cold water, within proper bounds, it is likely to be the production of much benefit as a remedial agent. Several vegetable and animal infusions and decoctions are used as Diluents: but the substances in solution increase in no degree the diluent power of the water. Some of these infusions, however, are often useful in abating nausea, and in cleansing the mouth and fauces of the viscid mucus; others convey small quantities of nutriment in the most favourable form into the system. But all the advantages which can be expected from them may be obtained from simple water.

Under this view of the subject, our attention should be directed to water in the different states in which it can be employed as a Diluent; the extent of its diluting powers; and its real value as a remedy in the treatment of diseases.

* I considered the term "intemperance" justly applied to the quantities drank by the votaries of Vincent Priessnitz, the projector of the Hydropathic system of curing diseases. See Claridge on Hydropathy.

TABLE OF DILUENTS.

* NATURAL FLUIDS OPERATING AS DILUENTS.

a.—Rain Water.	*Aqua pulvia.*
Var. 1. Ice Water.	
2. Snow Water.	
3. Spring Water.	
4. River Water.	
5. Lake Water.	
b.—Well Water.	
c.—Distilled Water.	

** VEGETABLE DECOCTIONS AND INFUSIONS OPERATING AS DILUENTS.

a.—Toast Water.	*Aqua Tosti Panis.*
b.—Apple Water.	*Aqua Pommarum.*
c.—Barley Water.	*Decoctum Hordei.*
d.—Gruel.	——— *Avenæ.*

*** ANIMAL SECRETIONS, AND PREPARATIONS OF THEM, OPERATING AS DILUENTS.

a.—Milk.
b.—Rennet Whey.
c.—Tamarind Whey.

WATER.

The ancients regarded water as one of those bodies which they believed to be the elements of all other bodies; and the belief of its elementary nature, modified by some experiments of Van Helmont and of Mr. Boyle, which apparently demonstrated that it could be changed into all vegetable substances and into earth, prevailed until past the middle of the eighteenth century; when Macquer having fired some inflammable gas in a glass vessel, drops of a clear fluid wero condensed upon the sides of the vessel, and appeared to him to be pure water. But it was not until the year 1781, that the experiments of Mr. Cavendish unequivocally demonstrated that water is a compound of *hydrogen* and *oxygen*, in the proportion of 1 atom of the former = 1 + 1 of the latter = 8, making the equivalent = 9: or 11·1 parts of hydrogen + 88·9 parts of oxgen = 100·0 parts of water.

Water is almost universally diffused over the surface of the

globe, and occupies more than three fourths of its surface; yet it is not found perfectly pure in any place; even the rain and snow that descends from the clouds, the condensation, as it were, of a natural distillation, are slightly tainted by traces of saline matters; which circumstance can only arise from the great solvent power of water enabling it to take up a portion of most substances with which it comes into contact in its natural condition. In many lakes, and in the ocean, the quantity of saline matter is so great as to render the water unfit for diluent purposes; but, when sea water freezes, the saline impregnations are deposited; and the ice affords tolerable fresh water. In the state in which water can be used as a diluent, its impregnations must be in small quantity, and not sufficient in general either to dim its transparency, or to give it colour, or smell, or taste, and consequently to render it unfit for the ordinary purposes of life. Water which is transparent, colourless, inodorous, and tasteless, is, therefore, *good* and *pure:* but it is not necessary that it should be in this pure state for common use; although it ought not to contain so much matter in solution as to affect the nerves of the stomach more than distilled water containing the same quantity of atmospheric air which good spring water contains; nor should it contain soluble salts in sufficient quantity to stimulate the bowels to increased action. Its diluent properties are counteracted by obvious quantities of such impregnations.

Water fitted to answer the intention of a Diluent must be one or other of the following kinds:—

1. *Rain water,* which includes *ice* and *snow water, spring* and *river water,* and *lake water:* 2. *well water:* 3. *distilled water.* Let us examine each in the order in which they are named.

a. Rain Water (*Aqua Pluvia*) is the purest kind of natural water. It is either an actual distillation from the water on the surface of the earth, taken up by the solvent power of the air and again precipitated; or it is produced, in the higher regions of the atmosphere, from the immediate combination of its principles by the influence of the electrical fluid. In whichever of these ways it is formed, *Rain Water,* if collected at some distance from a town or from houses, and not at the commencement of a shower, is good water, and as free from foreign matters as any natural water can be. In specific gravity it scarcely differs from distilled water. It, nevertheless, generally holds in solution *common air, carbonic acid, carbonate of lime, carbonate of ammonia**, and a trace of *nitric acid.* If it be collected from the roofs of houses, after it has rained for some time, it contains a sulphate of lime, and occasionally carbonate of lead. The quantity of common air in Rain Water does not exceed 3½ cubic

* Leibig. Organic Chemistry, applied to Agriculture, &c. &c.—Transactions, London, 1840.

inches in 100 cubic inches of water; it is more oxygenous than atmospheric air; the same quantity of Rain Water contains one inch of *carbonic acid gas*. Bergman and Brandes detected *chloride of potassium, chloride of magnesium*, and *sulphate* and *carbonate of magnesia* in Rain Water. These combinations, in the small quantities in which they exist, in no degree injure the diluent properties of Rain Water. It is indeed to the presence of the two elastic gases that Rain Water owes the taste which renders it palatable to animals and useful to vegetables. Ice melted into water, being destitute of these gases, affords an extremely vapid fluid: fish cannot live in it; and it does not seem either to quench thirst, or to be so complete a solvent in the stomach as Rain Water. To purify Rain Water and render it useful, even for the delicate purposes of chemical experiment, Morveau recommends dropping into it a little barytic water, and then exposing it for some time to the atmospheric air. This combines with the carbonic acid, which being the solvent of the carbonate of lime, both it and the carbonate of baryta are precipitated as insoluble salts; but lime water is a safer adjunct than the barytic water, and causes the same precipitate. Instead of exposing it to the atmosphere, it may be poured from one vessel to another; by which means not only the minute portion of barytic water or lime water is dispersed through the rain water and brought into contact with the carbonic acid, but it involves a great portion of air in its substance, which improves both the taste and the utility of the fluid. When it is collected near houses, it should be boiled and strained before being used: and it should not be collected in leaden cisterns; as the purer the water is, the more energetic is its action on lead; and the greater quantity of carbonate of lead is formed.

Var. 1. 2. *Ice and Snow Water, Aqua nivalis*, differs from rain water only in not containing so much air*; and, therefore, it should be exposed for some time to the atmosphere, or poured from one vessel into another, alternately, for some time before it is used as a Diluent. The opinion that *Snow* Water causes bronchocele is erroneous. The disease is unknown in Thibet and Chili, although the rivers are chiefly fed by the melted snow of the mountains. Ice water at sea is fresh, except when it has involved in it some salt water during its freezing; and as this is often the case, it is unfit to be used as a diluent.

Var. 3. *Spring Water* (*Aqua Fontana.*)—Rain Water, when it falls on high grounds, enters the soil and filtrates through it, until it is stopped by some natural obstacle, when it pushes upwards, and, welling out upon the surface, forms *springs*: the

* This air is, nevertheless, richer in oxygen than even that obtained from rain water: it contains 34.8 per cent. of that principle; whereas the air from rain water contains only 32 per cent.

water is, therefore, merely a modification of Rain Water. It is rare that the stratum is so purely siliceous or flinty, that it does not meet with some soluble matter in its passage; and, consequently, it is less pure than distilled water. The purest spring water generally contains a little *carbonate of lime, chloride of sodium*, and the usual proportions of air and carbonic acid gas. The presence of these are detected by diacetate of lead, which displays the smallest portion of carbonic acid or a carbonate, and nitrate of silver, which develops the chlorides by the formation of chloride of silver; sulphates are detected by the solution of any barytic salt.

The water of the spring called St. Winifrede's Well, in the town of Holywell, in Flintshire, is, perhaps, the purest in this kingdom. It rises, with effervescence, out of the crevices of a solid limestone rock; is as transparent as crystal, pure, and well tasted; and at one time it acquired much celebrity in the cure of cutaneous affections and painful diseases of the kidneys and bladder; but its celebrity is now much lowered. The Malvern spring, which possesses similar properties, is now more resorted to than that of Holywell. The water is clear and pellucid, and retains this state on standing. The most correct chemical analysis has detected scarcely any foreign matter, except some carbonic acid, in the Malvern water; and consequently the benefit which it produces is to be attributed to its great purity augmenting its diuretic and diluent properties. In all cases, it improves the appetite, increases the flow of urine, and elevates the animal spirits—effects likely to result from the improvement which the water effects on the secretions. Malvern water is resorted to chiefly by those who are labouring under scrofulous and cutaneous diseases. According to Dr. Percival's account, it has the property also of dissolving the little sabulous calculi which are often voided in nephritic affections. It is more than probable, however, that the benefit arises altogether from the diluent properties of these waters.

Matlock, in Derbyshire, possesses springs of very pure water, arising out of a compact limestone rock. All of the springs issuing from this rock possess the characters of pure water, being beautifully limpid, and having the taste of good water; but it is singular that all those which rise from fifteen to thirty yards above the Derwent are tepid, whilst those both above and below this limit are cold springs. The tepid is the lowest in temperature of any thermal water in Great Britain, not exceeding 66° of Faht.: it exhales no vapour, except in very cold weather. It contains a small quantity of bicarbonate of lime when it first rises, and therefore curdles soap; but the excess of acid soon disappears, and the lime is precipitated. In all its other properties it resembles the best spring water.

Var. 4. *River Water. (Aqua Fluviatilis.)*—This is merely

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spring water, which, from exposure to the air, has deposited much of its earthy salts, and has consequently become softer than as it welled from the spring. Mountain rills, as they generally issue from siliceous rocks, and run over stony or pebbly beds, are remarkably pure and soft. The river water in Wales, Scotland, Switzerland, and all mountainous districts, is of this description. The water of the Thames, although loaded with mud almost from its source, yet, is soft; and, when filtered, it is as good and fit for diluent purposes as that of the purest mountain rill.

In rivers, the exposure of the water, and the course which it runs from the springs whence it arises, soften it; therefore, River Water, in general, contains less calcareous matter than spring water; the specific gravity is less, and the taste more vapid. The water of rivers, however, is tainted with the nature of the soil over which their course extends; consequently, some which are pure and excellent at their sources lose their properties before they mingle with the sea. The water of the Thames, which is naturally very soft and excellent, becomes so loaded with animal and vegetable matter, from the towns and villages on its banks, that, after being kept a month or two in a closed cask, on opening it, a quantity of sulphuretted hydrogen gas, of the most offensive odour, escapes, and the water is so black and nauseous as to be unfit for use. But on racking it off, it clears, depositing a quantity of slimy mud, and becomes remarkably clear, sweet, and palatable. A gallon of Thames water, taken up at Chelsea, contains 16½ grains of carbonate of lime and nearly 3 grains of sulphate of lime and chloride of sodium, whilst the vegetable and other ingredients scarcely exceed gr. ss. In truth, the matters deposited in the Thames, the Seine, and all rivers traversing great towns, are merely mingled with the body of water, which is too large and too changing to admit of any permanent taint from solution; consequently filtration, or the natural deposition of the ingredients, fits them for every domestic and medicinal purpose.

Var. 5. *Lake Water, Aqua ex Lacu,* including that of ponds, owing to the vegetation generally going on at the bottom when the sheet of water is shallow, or owing to its stagnant state when it is deep, is generally vapid; but it is soft, and, when filtered, is as good and wholesome as any other description of soft water.

b. Well Water. *Aqua Puteana.*—This is, in fact, spring water, rising deep within the bowels of the earth, when an opening is made so as to enable the underground stream to rise towards the surface. It is characterized from spring water, which wells out spontaneously upon the surface; also, by its hardness, depending upon earthy salts, especially sulphate of lime, a large proportion of air, and a greater specific gravity than other spring waters. It does not break soap, as the term

is; that is, instead of making with it a pure opaline solution, it curdles the soap when it is agitated in it, owing to the lime of the calcareous salts which it contains forming an insoluble compound with the margaric and oleic acids of the soap. Although this property of Well Water renders it unfit for many operations, yet it is perfectly well adapted for the general purposes of dilution. When, however, the earthy salt, the sulphate of lime, is very abundant, it causes a sensation of weight in the stomach in that condition of the organ which exists in dyspepsia. The abundance of this earthy salt in the water of Paris and in the waters of many parts of Switzerland produces an uncomfortable feeling to strangers who first visit these places. It is also said to produce calculous complaints in the inhabitants—a result which, however, cannot be attributed to any earthy deposit in the kidneys, but to the low solvent power of the water not being sufficient to carry off the animal acid, which concretes in the kidneys to form calculi. Well Water can be easily freed from these earthy salts: boiling precipitates the carbonate of lime by driving off the carbonic acid which holds it in solution; and the addition of a little carbonate of soda precipitates the lime, if it really exist in the water.

If it have filtered through granite or quartz rocks, Well Water is very pure; but, in general, it contains various matters, according to the nature of the strata through which it has flowed. When the contents are in notable quantity, either to the smell or taste, it is unfit for use as a Diluent. *Hard Water* generally contains calcareous carbonates, sulphates, and chlorides, besides common salt; *Soft* Spring Water differs from Hard Water chiefly in containing few or none of the calcareous salts. Hard Spring Water, unless previously boiled, cannot be always employed as a Diluent; in weak and irritable stomachs, owing to an uneasy sensation of weight at the stomach, already mentioned; and, when long used as a daily beverage, it produces a degree of dyspepsia, to which we must attribute the calculous deposits which Dr. Percival and others have observed to be common in places where hard Water is drunk*.

c. Distilled Water. (*Aqua Destillata.*)—Water which contains no volatile matter, when passed through the still, is the purest form of this important fluid. It is beautifully transparent, colourless, perfectly void of taste and smell, and lighter than any other water; for even the admixture of carbonic acid and other gases in common water renders this specifically heavier than distilled water. It feels also softer to the touch, and the fingers are instantly wetted with it. Another singular property of Distilled Water, is that of producing a greater sound than common

* The following are the tests for water: 1. *Litmus*, for indicating a free acid; 2. *Lime Water*, for carbonic acid; 3. *Chloride of Barium*, for sulphates; 4. *Nitrate of Silver*, for chlorides; and *Oxalate of Ammonia*, for lime or salts of calcium.

water, when it is poured from one vessel to another. It dissolves soap into a pure opaline mixture; and may be added to a solution of soap in spirit of wine without causing any opacity. Lime water, barytic water, solution of nitrate of silver, and the oxalates, produce no effect on it. If kept free from the access of matters floating in the air, time produces no change on Distilled Water: it freezes exactly at 32° Faht. and boils at 212° under a pressure of the atmosphere of $29\frac{8}{10}$ inches. The purest Distilled Water is obtained from Rain Water, once distilled, rejecting the first and last products. When the water to be distilled contains carbonic acid, if the temperature be low, this gaseous fluid passes over with it; and, therefore, the first part of the product precipitates the diacetate of lead.

Distilled Water is the best solvent of all soluble animal and vegetable matters without decomposing them; on which account, could it be more easily procured, it would be the best and most wholesome beverage for common use that can be employed, and might be rendered sufficiently palatable by agitating it mechanically with the air, which it rapidly imbibes. As a medicinal agent, it not only answers every indication required from a Diluent, but effectually washes out the pelvis of the kidneys. It is the most perfect of all Diluents, liquifying without changing the properties of both animal and vegetable substances with which it is united. It has been recommended as a solvent of concretions in the kidneys*, and in gout, scrofula, phthisis, and cancerous affections†; but although we are of opinion that in none of these diseases much confidence is to be reposed on its solvent powers, yet it cannot be denied that as a Diluent it is more likely to pervade the minutest vessels than waters containing foreign ingredients, either gaseous or solid; and, therefore, could it be easily and cheaply procured, it ought always to be preferred when simple dilution is required in the treatment of diseases.

* * DILUENTS CONTAINING VEGETABLE INFUSIONS AND DECOCTIONS.

a. Toast Water. *Aqua Tosti Panis.*—This form of administering water has been long in use. It is made by pouring, on a piece of well-toasted bread, water which has been boiled and allowed to cool; a small piece of lemon-peel is sometimes added. The toast communicates taste and colour to the water; but its diluent properties are not different from those of pure water.

b. Apple Water is made by slicing Apples and pouring

* See a paper, by Dr. Heberden, in the Medical Transactions, vol. i.

† See Dr. Lambe's Medical and Experimental Inquiry into the Origin, Symptoms, and Cure of Constitutional Diseases, &c. 8vo. 1805.

over them boiling water, to which a slight degree of acidity and the flavour of the fruit is communicated.

c. LEMONADE. This is made by adding fresh lemon juice, with a small portion of lemon peel and sugar, to water that has been boiled, then cooled, and again boiled to make the mixture. If not too acid, it is a cooling and agreeable beverage in fevers.

d. DECOCTIONS OF BARLEY.—These decoctions, carefully prepared, according to the directions of the Pharmacopœias, are well adapted for diluting in fever, phthisis, gonorrhœa, and many other acute diseases; and, however trifling they may appear, they contribute much to the efficacy of the treatment in these affections. Hippocrates wrote an entire book concerning their use, and that of boiled barley, in acute diseases. Besides diluting, they afford some degree of nutriment to the body; and the simple decoction, when mixed with an equal quantity of milk and a small portion of refined sugar, is a good substitute for the breast milk, for infants who are unfortunately brought up with the spoon. The following are officinal forms for making these decoctions.

BARLEY WATER, *Decoctum Hordei,* L. D. is made by boiling ℥iiss (℥ii, D.) of well-washed pearl barley in Oivss of water, using Oss of it in the first place to boil the barley in for a few minutes. This fluid is then strained off and the barley reboiled in the other Oii of the water, poured on it boiling hot; then concentrated to Oii, and strained.

COMPOUND DECOCTION OF BARLEY. *Decoctum Hordei compositum.* L. *Mistura Hordei.* E.—The London College orders it to be made by boiling ℥iiss of sliced figs, ʒv of sliced and bruised liquorice root, and ℥iiss of raisins, in Oii of Barley water and Oi of water, down to Oii, and strained. The Edinburgh College orders ℥ii each of pearl barley, washed; sliced figs; stoned raisins; and sliced and bruised liquorice root, and Ovss of water: the barley, being first boiled in Oivss of the water down to Oii, is strained and diluted with the rest of the water; and the other ingredients are then to be added, and the whole, being boiled down to Oii, is to be strained.

* * * DILUENTS CONTAINING ANIMAL SECRETIONS.

MILK AND WATER. *Lac c. Aqua dilutum* has always been regarded as a useful and agreeable diluent in acute diseases. It may be drank *ad libitum.*

RENNET WHEY. *Serum Lactis.*—Milk consists of fatty globules, which constitute the cream or butter, caseine or cheesy matter, sugar of milk, chloride of potassium, alkaline phosphates, and lactates, phosphate of lime, and water. When rennet is added to it, and the mixture is moderately heated, the caseine is precipitated and rendered insoluble in water; hence it is readily separated from the water, containing the sugar of milk and the

salts, which constitute the whey. Too much rennet gives the whey a disagreeable, saline taste.

Whey, thus prepared, is a useful and agreeable diluent in fever and other diseases of excitement.

TAMARIND WHEY. *Serum Lactis e Tamarindis.*—To make this whey, two ounces of tamarinds are infused in Oi of warmed milk, coagulation takes place, after which the whey must be strained from the curd, in the same manner as in making rennet whey.

It may be used ad libitum, as a diluent in fever.

Use of Water as Aliment.

The use of water as an aliment may he said to be universal in organized nature. In the members of the vegetable race, every portion of the nutriment which they derive from the soil or from the atmosphere must be in a fluid state before it can be taken into their system and assimilated to their substance; and as the lacteals, which may be regarded as the animal roots, cannot admit gross matters, it is evident that a considerable degree of fluidity is also necessary for the food of animals. Although the division of the substances which water liquifies is required to be less minute to enter the animal than the vegetable vessels, yet it is requisite that they also should be held in solution, or at least suspended in a fluid medium, before they can be regularly conveyed into the animal system. But water, besides performing this office, is itself an alimentary substance; without the presence of which, in a certain definite proportion to solid matter, life could not be maintained. It is evident, therefore, that the presence of a certain quantity of fluid is essential in the process of digestion to enable the gastric juice to exert its solvent powers regularly upon the contents of the stomach. It has been supposed that, in a vigorous and healthy state of this organ, the presence of more water than is required to give a due solubility to the food must retard digestion; but this is an error; and nothing can be more demonstrative of its being so, than the improvement to the digestive function which follows the use of water prescribed in the hydropathic system of curing diseases. Still it is reasonable to suppose too much will so weaken the activity of the gastric fluid as to permit the food to pass into the same fermentative process which it would do were it placed for a given time in a common vessel, at the temperature of the stomach. In the healthy stomach, this chemical action is generally overcome by the vital powers of the organ; but these languish, if the secretion which it supplies for the formation of chyme be too dilute. Hence the impropriety of the over-supply of fluid in which it is too common to indulge in at meals. It is not my intention, however, to imply that no more drink should be taken than is absolutely necessary for the moderate solution of the solid

part of our food; for, were the chyle diluted only to this extent, it is probable that its rapid animalization would afford that state of over-tonicity, if we may employ such a term, to the solid fibre, which would tend to the production of inflammation and all its subsequent train of evils. On the contrary, if the spontaneous chemical changes which the food, mixed with water at a certain temperature, would undergo out of the body be permitted to occur in that organ by over-diluting the gastric juice, the consequences must be acidity, heartburn, eructations, and the whole train of symptoms that characterize dyspepsia.

In the duodenum, the bile and the pancreatic juice combine with the chyme; and here the presence of a certain quantity of fluid is as essential as in the stomach; nor is it less so during the passage of the chyme through the intestines; at least, until it enters the large intestines, which, from the structure of their villous coat, are evidently not naturally intended to absorb it, and in which the insoluble portion of the food, becoming less and less fluid, is carried forward and ejected from the body. It is unnecessary to trace the influence of water in carrying forward the chyle through the lacteal vessels until it reaches the left subclavian vein to be mingled with the blood. But the importance of a due supply of water to the system does not terminate here: it is essential to the preservation of the proper balance between secretion and excretion—so necessary to the healthy state of the system.

The first change to which the chyle is subjected, after it is mingled with the circulating mass, is its exposure, with the venous blood returned from every part of the body, to the action of the air in the lungs. Here the carbonaceous part, which is necessary to be thrown off, is carried out of the lungs in combination with a large portion of aqueous vapour. A similar removal of noxious or useless matters takes place in the excretion of the skin and the kidneys; and this removal, which is as necessary for preserving the health as the daily supply of food, is greatly favoured by dilution. Were it necessary to prove, by any other arguments, the utility of water as an aliment, and as favouring every salutary process connected with the support of vitality, we might mention some of the many well-authenticated cases of persons having lived on water alone, under circumstances which precluded them from obtaining any supply of solid aliment. But, after all, the salutary or noxious influence of water as a Diluent must necessarily depend on the nature of the food, and the condition of the stomach to prepare that food into proper chyme, adapted to afford healthy chyle, and support for the body. If the food be naturally watery or bland in its quality, little dilution is requisite: among the lower animals, those that live upon succulent herbage require little or no drink: on the contrary, a flesh diet requires to be accom-

panied with more dilution, not only on account of its ready assimilation, but on account, also, of its liability to undergo changes which are in some degree noxious, and require to be obviated.

These circumstances, in a healthy state of the stomach, modify the necessity of dilution: but the powers of the stomach itself, or its digestive faculty, may be defective from causes not originating in the organ; and in either case the regulation of the fluid aliment of the individual becomes an object of primary importance.

No water which contains so much foreign matter as to place it within the class of mineral waters can be employed as an ordinary Diluent; and even hard or well water, as we have already stated, when daily used, proves injurious. The fact is well known to horse jockeys, who, when they are desirous to sell a horse to advantage, give him either spring water, or water which has been boiled, for drink; well knowing that the use of hard water makes his coat rough.

Remedial Use of Water.

The influence of water on the diseased body is modified by three circumstances connected with the state of the fluid—1, the caloric with which it is combined: 2, its bulk: 3, its solvent power.

1. With regard to temperature, water answers the double intention of diminishing the heat of the mouth, the fauces, the stomach, and, by sympathy, that of the whole body, and of fulfilling the purposes of Dilution. But, in admitting this, it is proper to remark, that the degree of cold which can be safely borne must be carefully ascertained. In a debilitated frame, water at a temperature under 45° is apt to prove injurious; for, when the reaction which the application of cold, whether to the surface of the body or to the stomach, should induce, is too languid, the stomach becomes oppressed, and general sinking may occur. In this case the temperature of the Diluent should be between 60° and 70°; and this fact should be borne in mind —that water at 60° merely dilutes; whereas, water under 60° and above 45° proves either tonic to the stomach, or causes an injurious sensation of cold in it, which is transmitted to the general frame. One standard by which, however, the temperature of water, used as a Diluent, may be safely measured, is to be found in the degree of the animal temperature at the time, keeping in view the vigour of the frame and the character of the disease.

Looking at this part of our subject in the most general point of view, we may lay it down as an axiom, that water, to operate as a simple Diluent, is most effective the nearer it approaches

in temperature to that of the body. It is undoubtedly less grateful to the palate at this temperature than between 45° and 60°; but this is the most useful temperature. It is a common opinion, that warm water, habitually employed, has a debilitating effect on the stomach: I apprehend that this opinion is unfounded; at least, my experience leads me to regard it as a mistake. On the contrary, water between 65° and 70° improves both the appetite and the general health.

In fever, when the habit is vigorous, and the reaction of the stomach strong, as low a temperature as fluid water can admit of may be employed. The immediate effect upon the stomach will be rapidly communicated to the skin, and the same result be obtained as if the whole body had been immersed in the fluid; the pungent heat will be diminished, and a copious perspiration follow; at least, such is the general result. The period of the febrile paroxysm must also be taken into account; for if water at this temperature be drunk in the cold stage, it augments the sensation of cold at the surface, oppresses the præcordia, and renders the pulse feeble, and at the same time more frequent: if given during the flow of perspiration, it may check this salutary excretion; and, in either case, the patient must suffer. The Diluent, in the different stages of a fever, should be first of a temperature above 70°, when the rigors are present; then cold, as the hot stage proceeds; and, lastly, tepid, when the perspiration flows freely.

Independent of the effect of water in fever, it is essential to attend to its temperature when it is used as a general Diluent. Those who have irritable stomachs cannot bear a draught of very cold water with impunity; and a temperature approaching to 70° is demanded. In the dyspeptic, there is frequently a distressing and gnawing pain, arising from the acrimony of the undigested food, combined with heartburn. Nothing relieves this state so suddenly as a draught of water, taken as hot as it can be drunk.

2. With respect to the influence which the *bulk* of the liquid exerts in modifying its diluent effect, we may merely observe, that although much of the benefit to be derived from the diluting properties of water depends on the regulation of the quantity thrown into the system, yet there is no standard by which this can be easily determined. Much depends on the condition of the excretory organs at the time; namely, the skin, the lungs, and the kidneys. But, under every condition of these organs, a large quantity of water, taken into the stomach, oppresses from its bulk, in the same manner as any other distending cause. It is possible, also, that the arterial system may be overloaded, not so much from the bulk of the water taken as from a diminished action of the cutaneous exhalants and other excretories. Much water, in this condition of the system, if

taken into the stomach, may cause tension and fulness; and is not unlikely to produce a sudden determination to the head, which, in languid habits, may cause apoplexy—a disease not unfrequent in the worn-out invalids who resort to watering places and incautiously take large draughts of water; and this sometimes occurs when no fever is present.

3. But the most important circumstance modifying the influence of *Water* as a *Diluent* is the degree of *solvent* power which it exerts. This necessarily will depend much upon the temperature of the water, and the nature of the contents of the stomach which it is intended to act upon. If the latter be of easy solution, we must enquire how they will operate in this state, and be regulated by the result, in fixing the extent of dilution. Thus, if a poison be taken into the stomach, which requires to be in a state of complete liquidity before it can operate, it would be dangerous to throw in water or any other fluid, until tho greater part of the offending substance be removed, either by vomiting or by other means; but, this being accomplished, then the most ample dilution will so weaken what remains as to render it inert, and aid greatly in carrying it out of the body.

Such are the general effects of water as a diluent on the animal system, both in the state of health and that of disease: it now remains only to examine briefly its practical utility as a remedy.

If we look into the history of our profession, we shall find that water was the chief remedy employed by Hippocrates in the treatment of fever; sometimes in its pure state, sometimes mixed with vinegar. He varied the temperature of the fluid according to the seasons of the year: in winter, recommending it to be used in a tepid state; in summer, as cold as it could be procured. Galen concurred in this excellent practice; but with some, not injudicious, restrictions respecting the quantity, the condition of the patient, and the period of the disease. Among the ancients, however, the use of water, even in fevers, was condemned; particularly by Asclepiades: but the judicious Celsus concurs in the propriety of this practice. Among the moderns, Stahl (whose theory was useful, inasmuch as it led men back to Nature) first introduced the liberal use of water in fevers. Hoffman, who followed Stahl in many things, restricts its use in these diseases; yet he was a great supporter of its efficacy as a general remedy, and wrote a work expressly to prove its value.

In Spain, where medicine has not arrived at the same degree of perfection as in this country, cold water is still, as it has long been, the principal remedy in fever; and, in what is termed the *dieta aquæa*, from five to ten pints are ordered to be taken daily. But this is nothing to the extent to which this

diet was formerly carried; and which was the occasion of the well-known satire of Le Sage, in the excellent novel of Gil Blas, in which this part of the practice of the Spanish physicians is very happily ridiculed in the person of Dr. Sangrado.

In England, water was little used in fevers until the commencement of the eighteenth century, when it was introduced by Dr. Smith, an able physician, and Dr. Hancock, the author of "*Febrifugum Magnum*," a Doctor of Divinity, Rector of St. Margaret's, Lothbury. Those innovators carried some of their particular opinions, especially those respecting the use of water as a febrifuge, to an extravagant length, and brought discredit upon the practice. In the present day, a more intermediate course is pursued; the advantage of dilution in fevers is well understood and appreciated; and, at the same time, the limits to which it may be carried are as well known. A physician does not now order water in quantities sufficient to injure as greatly by its bulk as it is calculated to benefit by its diluent properties; but he leaves the quantity to be regulated, in a degree, by the desires of the patient. This is undoubtedly the best guide; and it has been remarked by every writer on diseases, that, in acute fevers, the inclination for watery fluids is so striking as to be almost a measure of the degree of fever which rages. As simple water contains nothing in itself noxious, the attention of the physician is required to be directed only to quantity and temperature. And, with regard to both these circumstances, we have already expressed our opinion: the measure of both may, in truth, be left to the patient.

In the phlegmasiæ, particularly in those instances in which the part affected is extensive, as in inflammation of the serous membrane lining the cavity of the thorax, and in similar cases, mild and diluent drinks ought to be plentifully administered. Whether these consist of water only, or of vegetable infusions or decoctions, they should never be given cold, but moderately tepid, and in small successive portions, frequently repeated. Of all the phlegmasiæ, that one which most demands the use of Diluents is nephritis. The excretory power of the kidneys is much diminished by inflammation in the organ; and the nature of the part affected has generally been regarded as requiring that the Diluents should be of a mucilaginous kind; but tepid water answers every intention, and it may be more freely administered than is admissible in any of the other diseases of the order.

In the eruptive fevers, comprehending small-pox, chicken-pox, measles, scarlet fever, nettle-rash, and similar affections, Diluents, and particularly water, may be used ad libitum. In that form of small-pox in which the pustules are distinct, cold water may be freely administered during the whole period of the eruptive fever; in the confluent, it ought to be tepid. In

measles, also, the Diluents should be tepid; but, in scarlet fever, as all catarrhal symptoms are absent, and the most distressing circumstance is the burning heat both of the skin and the viscera, the coldest water which can be procured should be administered. It answers nearly the same purpose as the cold affusion, or cold water applied to the surface during the period of excitement. In both cases, the heat is rapidly diminished, the skin becomes soft, the general irritability of the system is lessened, sleep is induced; and often the most alarming cases are converted into the most moderate and manageable.

In catarrh, the acrimony of the secretion of the mucous membrane led to the supposition that mucilaginous drinks were requisite; but experience has proved that water is capable of answering every purpose for which dilution can be required in this disease. It is almost unnecesary to say that, whatever fluid is taken, it ought to be in a tepid state.

In no disease is copious dilution so requisite as in bilious cholera. Indeed, the chief indication, in the commencement of this disease, is the evacuation of the redundant bile upon which both the vomiting and purging characterizing the attack depend. No medicines are required, nor would any be effectual, until the bile is, as it were, fairly washed out: tepid water accomplishes this better than any other Diluent. The same may be affirmed respecting bilious diarrhœa.